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Improvement in Export Trade.

The bettered conditions in export trade that were noticeable in May are again seen in the electrical figures for June. The value of electrical instruments and apparatus was $421,732 in 1908, but had risen to $595,744 for June of the current year. The export of heavy electrical machinery was $667,453 as compared with $659,497 a year ago. The items added together show a gain of $181,268, or not very far short of 20 per cent. Such a rate of gain if maintained would soon restore the high-notch figures of 1906-7.

We have with the figures for June the totals of the 12 months, which may be cited. The total for electrical instruments was $6,074,865, or about $700,000 less than the preceding year. The total for electrical machinery was $6,449,526, or very nearly $2,000,000 less. The respective figures for the three fiscal years come out as follows, adding together electrical instruments and machinery:

	Instruments.	Machinery.	Total.
1906-7	$8,262,640	$9,005,766	$17,268,406
1907-8	6,754,217	8,495,219	15,249,436
1908-9	6,074,865	6,449,526	12,524,391
	$21,091,722	$23,950,511	$45,042,233

This is an interesting table in many respects. The two classes of apparatus are seen to be divided pretty evenly over the whole period, while it brings out the sharpness of the decline in gross since 1906 up to the time of the present rally. The total of $45,000,000 is quite respectable, but we hope that the next three years will average even better than $15,000,000 a year.

Our best customer for electrical instruments by long odds in all three years was British North America, averaging about $1,400,000 a year. In 1906-7 the United Kingdom took $1,580,615, but in the last fiscal year that amount was cut to $583,374. Brazil has been a good steady customer, averaging nearly $1,000,000 a year, while Mexico has averaged $700,000. Japan was a large customer once, but last year took only $254,928. In the line of heavy electrical machinery, the conditions change somewhat, and Japan proves to be our "best buyer" with an average of $1,300,000 a year, while British North America took about $1,100,000 each year, and Mexico just a shade less. For the last year Japan took $1,175,208, or $400,000 more than Mexico, which came next. The demand from the United Kingdom declined in the three years from $1,139,165 to $608,146. There are evidently many opportunities for a marked rally as well as for an increase everywhere and the improvement in world trade will help bring this about. But more will depend on the attitude of the manufacturer and exporter and his enterprise in seeking a market for many lines of goods not now known or placed abroad.

Avoiding Electrical Accidents.

An extremely interesting article is published in the present issue from Mr. Robert J. Young, the safety inspector of the Illinois Steel Company, on electrical accidents around machinery and their prevention. The increasing use of electrical energy on a large scale around industrial establishments renders necessary the adoption of numerous precautionary measures, and it is greatly to the credit of the steel corporations of this country that not only do they recognize this fact, but employ special officials to give effect to the rules and regulations that have been adopted. We desire to call attention in particular to the devices illustrated in Mr. Young's pithy article, and to the polyglot signs that are employed for purposes of warning.

These are highly useful in a country where so much of the lower grade of labor is of foreign origin and where the immigrant heads of large families are often unable to speak or understand English. President Crawford, of the Tennessee Coal, Iron & Railroad Company, has also sent us some data of similar work done by his corporation, to which we propose to call attention later. The aroused interest in this subject is another proof that already the aims and efforts of the Museum of Safety, which thus seeks to safeguard labor, are not in vain, and these excellent examples strengthen its hands in the propaganda for protecting human life and limb. Incidentally we would suggest that such work in industrial plants is especially worthy of study by managers of electric light, power and railway systems.

Recognition of the Electric Vehicle.

Perhaps significant of the fact that the electric vehicle is no longer considered the Cinderella of the automobile family is the circumstance that about half of the papers read at last week's summer convention of the Society of Automobile Engineers in Chicago related to electrical subjects. Of the six papers presented two related to storage batteries, one to a test of a gasoline motor, one to energy consumption of commercial vehicles, one to an electric dynamometer for testing gas engines and one to lubricating oils. It will thus be seen that electrical subjects attracted a moiety and perhaps a preponderance of the attention of the convention. The liveliest discussion of the meeting centered around the use of the new mercury type of ampere-hour meter on electric vehicles, and the practice of installing this instrument came in for both praise and blame.

As a class automobile engineers have paid comparatively little attention to electrical problems, and it is an encouraging indication of the manner in which the electric vehicle is gradually coming into its own when the professional society of the great automobile industry—and a high-grade society it is, too, fairly comparable in the quality of its work to the associations maintained in other branches of engineering—gives so large a proportion of one of its conventions to subjects related to the unobtrusive but attractive, reliable and serviceable electric automobile. The society is young, and it is perhaps not strange that it has hitherto devoted its predominant efforts to the showy gasoline car, which looms so large in the public eye. But now that some of the electrical members have brought about a wider outlook on the part of the society, it is to be hoped that this breadth of vision characteristic of true engineering will continue in the future history of the organization. The advantages of this policy will be reciprocal, for both the electric-vehicle industry and the Society of Automobile Engineers will benefit by it. A brief report of the convention as it interests electrical readers appears elsewhere in this issue.

The Rio de Janeiro Power Plant.

Rio de Janeiro is, we believe, the first of the world's capital cities to be adequately supplied with transmitted water-power, save for the City of Mexico; and the capital of Brazil is by far the larger of the two. Few North Americans realize the splendid probabilities of the great republic of Brazil, with an area near that of the United States and natural resources probably greater. Brazil lies enough nearer the equator to have a climate ranging from tropical to temperate, instead of from temperate to sub-Arctic as with us, and lacks the arid stretches that make so much of our own Western country a region fertile only when irrigated. For this reason and because of its magnificent harbor Rio de Janeiro is a city destined for greatness in years to come, and it is most fortunate in having an adequate power supply within easy reach. As we have noted in a description of the Rio plant published earlier, it is distinguished for a very fine and capacious storage basin, large enough to equalize the flow of the stream for very long periods and deep enough to escape serious loss from evaporation, which in the tropics is no slight matter.

The voltage of transmission is high even from our standpoint, being 88,000 volts, and the distance is but 51 miles. The lines are in duplicate, each being of steel towers varying in height from 45 ft. to 60 ft. and in a small number of standard forms so that spare parts can be easily kept in stock. It is interesting to note that, as in many tropical regions, the annual variation of temperature is but small, far smaller than in the United States, so that a long span construction is easily carried out, with no fear of sleet and but little of high winds. The present article deals mainly with the matter of distribution of the transmitted energy and the methods adopted are of decided interest. The topography of the city enabled the company to secure a private right of way fairly into the city for the receiving station. Here the step-down transformers reduce the pressure from 80,000 volts to 6300 volts, three-phase, at which pressure the general feeders for lamps and motors are operated. A 23,000-volt circuit is also provided for suburban service. The general distribution is by means of a four-wire, three-phase system worked at 120 volts between outside wires and neutral, a system which possesses great advantages but has hitherto been used only in plants of rather moderate size. The secondary distribution is by armored cables with the transformers in vaults, where the 6300-volt cables are led. These latter are lead covered and paper insulated. There are 15 distributing stations with the circuit-breakers controlling the transformer capable of remote control from a single point, since the secondaries are all tied into a common network. This system of distribution has many of the characteristics of the direct-current Edison system in common use here, with the additional advantage of high-voltage feeders. It is quite as

flexible and convenient as a direct-current system and is probably considerably more efficient, especially when compared with a direct-current system worked via motor generators or their equivalent. From the standpoint of engineering progress it is very gratifying to see the four-wire, three-phase system worked on so large a scale and with a fair chance for being worked out on an adequate scale. It is quite as economical of copper as an ordinary three-wire, direct-current system, can work a combined lighting and industrial service quite as readily, and is particularly well adapted for big central-station operation. It might be a good idea for some of our central-station men to take a winter run down to Rio de Janeiro when everything is in full operation and see how the thing can be done when one is not tied down by precedents and really has a fair chance to make a fresh start at distribution on a large scale. It is gratifying that the work, even if not in our own country, is still done by Yankee enterprise and by Yankee engineers.

NATIONAL AND INTERNATIONAL ELECTRICAL ENGINEERING SYMBOLS.

The early medieval name for an engineer was *mathematikos*, or the man who could work according to definitely computed estimate. Ever since engineering has been recognized as a business, it has contained and stood for practical mathematical formulas. Probably as long as engineers and engineering shall last, engineering formulas will also last. Each branch of engineering has its own particular formulas which belong to the lares and penates of the guild. In electrical engineering, there are certain elementary and fundamental formulas, such, for example, as Ohm's law, that are of the first practical importance. These formulas are to be found in nearly every good text-book of electrical engineering. It is expedient and desirable that these fundamental formulas should be clothed in essentially the same garb, so as to be recognizable instantly. This requires that the algebraic symbols for the fundamental electromagnetic quantities should be everywhere the same. Nevertheless, there is danger in carrying this principle too far. It is hopeless to standardize, at present, the symbol for every physical quantity in engineering. There are too many quantities all told, too many branches of engineering and not enough alphabetical symbols. There is a just medium to be sought for. If we do not standardize engineering symbology at all, we have a horrid medley, and unnecessary confusion in literature. If we attempt to standardize too much, the labor and artificialty of the effort will surely make it abortive. The right air is then to take electrical engineering alone, and deal only with the most frequently used quantities, standardizing internationally in the direction of least resistance and commencing very modestly.

The comparative table of electrical engineering text-book symbology prepared by Dr. Kennelly and printed on page 374 presents the essential facts in a convenient form for examination and deduction. It is remarkable to find how much uniformity already exists, considering that no serious effort has yet been made internationally by electrical engineers to arrive at a uniform set of symbols. We hope that this research may receive the attention of the International Electrotechnical Commission. It should certainly assist that body to reach a preliminary understanding and resolution in the direction of international electrical engineering symbology. It appears that there are already half-a-dozen electric, magnetic or electromagnetic quantities ripe for international adoption as a nucleus, without calling for any appreciable change or national sacrifice, and not to speak of half-a-dozen more auxiliary and subsidiary quantities that are also practically ripe. If the commission would start with the adoption of an international list of these dozen quantities, a great step would be made, and a great international advantage secured. The remaining discrepant symbols could then be brought into line gradually, and without haste. The important thing is to make a start.

It is doubtful how far the representatives of different countries in the International Electrotechnical Commission could go in accepting modifications of symbology. It is one thing to agree to a change in committee, for the sake of international uniformity, and another thing to effect the change in literature and cold type. That is why we must expect the movement toward uniformity to be slow. Nevertheless, the movement will be sure if it is loyally fostered by the technical press in each country. Without arrogating to ourselves any immoderate praise, we freely admit that this journal has had its share in changing the symbol of electric current from *C* to *I*, in order to conform to international usage. Prior to the Chicago Congress, everyone in the United States used *C* for current in engineering literature. Now *I* is almost invariably used. This fact shows that such changes can be made.

VECTOR DIAGRAMS.

An article entitled "The Use of Arrow-Heads in Alternating-Current Vector Diagrams" by Prof. A. S. Langsdorf in this issue calls attention to a feature of vector representation that is frequently overlooked, namely, the fact that each vector shows merely the time-phase relation of some one alternating quantity with respect to some alternating quantity chosen for reference as to time-phase displacement. That is to say, in polyphase systems it is necessary to consider the interconnections of the circuits as well as the time-phase relations of the individual currents and e.m.fs. in determining the resultant amperes and volts. To the error commonly made in assuming that the vector diagram of currents and e.m.fs. represents the interconnections of the circuits may be attributed the great confusion produced in the mind of one unfamiliar with the true conditions when he attempts to place arrows on a diagram used in demonstrating the measurement of three-phase power with two wattmeters.

In a balanced three-phase system the currents in the three conductors are displaced in time by 120 deg., as are also the e.m.fs. between adjacent conductors. As ordinarily, and correctly, represented, the arrows on the delta e.m.f. vectors follow around the diagram, while those on the star current vectors point outward. At first glance it would seem that when measuring power at zero angle of lag a wattmeter with its series coil in one conductor would reverse its reading when its shunt coil was connected first across between one and then the other remaining conductors. However, no reversal takes place, because simultaneously with the time-phase reversal of the e.m.f. to be impressed across the shunt coil there is a relative reversal of the connection of the shunt coil in circuit, and there is no change in the indication of the wattmeter.

Depreciation of English Electric Lighting Undertakings.

The English Board of Internal Revenue has agreed to arrangements proposed by the Tramways & Light Railways Association in regard to the proper allowances for depreciation of certain undertakings, including electric lighting.

According to the agreement which will be the basis for the income-tax assessment, in addition to repairs, allowance for depreciation of cables may be granted at the rate of 3 per cent per annum on the "written down" value—meaning the original prime cost, plus subsequent additions, less all allowances actually granted by the board in respect of wear and tear. On all plant and machinery, exclusive of loose tools, meters and office furniture, depreciation may be allowed at the rate of 5 per cent per annum on the written down value, in addition to the cost of repairs. No allowance is to be made for depreciation of conduits, meters, loose tools and office furniture, but the annual expenditure on repairs and renewals may be allowed as working expenses, as and when incurred.

The above proposals are to be treated as having been in effect during the year 1908.

Chicago Railway Contract for Electrical Energy.

On July 30, after negotiations extending over a considerable period of time, the Chicago Railways Company, which operates the surface street railways on the North Side and West Side of Chicago, entered into contract with the Commonwealth Edison Company for a large portion of the electrical energy needed to operate its cars. The contract calls for not less than 30,000 kw and will cover a period of about six years. The rate is $15 per kilowatt of maximum demand per year with an additional energy-consumption charge of 0.415 cent per kw-hour until Jan. 31, 1910. After that date the energy-consumption charge will be 0.4 cent per kw-hour for the remainder of the period. In its provisions the contract is substantially the same as the one previously entered into by the Chicago City Railway Company and the Commonwealth Edison Company for a similar service and for about the same amount of electrical energy. As is well known, the Commonwealth Edison Company does a remarkably large business in the way of supplying electrical energy at wholesale rates to electric railway companies in and near Chicago. Under existing contracts at the time of maximum demand next winter the Commonwealth Edison Company will be supplying about 80,000 kw to customers of this character—a record significant of the modern expansion of the business of supplying electricity.

Convention of Michigan Electric Association.

The Michigan Electric Association will hold its 1909 convention at the Hotel Tuller, Park Street and Adams Avenue, Detroit, Aug. 17, 18 and 19. The first session will be called to order Tuesday evening, Aug. 17, at 8 o'clock. It will be devoted to papers and discussions on light and illumination. The second session, which will be held at 10 o'clock Wednesday morning, Aug. 18, will be devoted to motor and industrial business. The third session will be held Thursday morning at 10 o'clock, and will be devoted to electric heating. The afternoons and one evening will be taken up with various entertainments which have been arranged for. One of these will be a boat ride on an excursion steamer followed by a dinner at Bois Blanc Island. The entertainment committee urges all members to bring the ladies, as special arrangements will be made for them during the convention sessions in addition to the entertainments which are provided for the entire membership. There will be only three sessions, Tuesday evening, Wednesday morning and Thursday morning, devoted to the three general divisions of the industry—light, power and heat. The secretary of the association is Mr. A. C. Marshall, Port Huron, Mich.

Electrification of Canadian Main Lines.

Hitherto the proposals to electrify main lines of railroad in Canada have been limited chiefly to the Western sections of the Dominion where large water-powers are abundant. U. S. Deputy Consul C. A. Steeves, at Moncton, now reports that the electrification of the Grand Trunk Pacific, or National Transcontinental Railway, from the St. Lawrence River to Moncton, is now under the serious consideration of the railway company, the Dominion Government and the New Brunswick cabinet. Electrical engineers who have given the subject consideration declare the conditions to be entirely favorable. The distance between the St. Lawrence and Moncton is about 460 miles, and for a considerable part of the distance the road passes through dense forests of spruce and fir in lower Quebec and northern New Brunswick, as well as through the rich farming country along the upper St. John Valley. What has given impulse to the new plan is that at Grand Falls on the St. John River, 170 miles from the St. Lawrence and 160 miles from Moncton, is located water-power sufficient to develop energy enough for the working of the whole road. At this point the river has a natural fall of about 130 ft. and a flow that electrical experts estimate will be sufficient to furnish from 100,000 to 125,000 hp continuously by the utilization of comparatively inexpensive means of storage and conservation. As the requirements of the road are estimated at not more than 40,000 hp, there is every reason to believe that the supply will be more than equal to the needs.

Mascart.

The issue for July 15 of *La Revue Générale des Sciences* contains a long paper by Prof. Paul Janet entitled "La Vie et les Œuvres de E. Mascart," which, in addition to giving an appreciative review of the personal career of the great savant and a scholarly analysis of his work, contains an account in detail of the circumstances attending the adoption of the volt ohm, ampere, coulomb and farad at the International Electrical Congress of 1881. Professor Janet, who enjoyed the intimacy of the subject of his contribution, brings out clearly the traits of character which charmed all who came into contact with Mascart. The attraction exercised by Mascart was peculiar in that it did not proceed from a spirit of bonhommie, for he never entirely laid aside the dignity of the savant nor by his manner invited familiarity from any source. It is related how Thiers came under his spell, and for several years during a period of great political activity preceding the Franco-Prussian War, stole away at every opportunity to Mascart's laboratory, where under his tutelage he indulged in experimental study covering a wide range of sciences.

The account Professor Janet gives of the adoption of the practical electrical units in 1881 is apparently based on information derived directly from Mascart, and previously unpublished. During the first stages of the discussion on the adoption of the units, differences of opinion arose, both with respect to expediency and nationality, which appeared to Dumas, president of the congress, and others, to indicate the impossibility of arriving at any international agreement. However, at a dinner at which Mascart, Kelvin, Helmholtz and Werner von Siemens, among others, were present, an agreement was reached which secured the adoption of the ohm and the volt, but left the matter of other proposed units in the previous unsatisfactory state. Finally, several days later at a luncheon in a small restaurant near the meeting-place of the congress, Mascart, Helmholtz and Kelvin came to an agreement which resulted in the addition of the ampere, coulomb and farad to the list of electrical units. It is interesting to note that a meeting of the committee on units at which the proposition would have been presented for discussion was not held owing to an order issued suspending routine work of the congress on account of the death of President Garfield. The proposition was therefore brought direct before the congress at its concluding meeting, to the surprise of some members of the committee whom it had not been possible in advance to enlighten as to the circumstances.

Telephone Development of Brazil.

Some very interesting facts are furnished by United States Consul-General George E. Anderson, of Rio de Janeiro, on telephones in Brazil and the demand for apparatus. An American company which is constructing a system for the State of Rio de Janeiro secured its concession about three months ago, and already has the construction well under way. One of the chief objects of the enterprise is to afford communication by telephone between Rio de Janeiro and the country surrounding it, including Petropolis, the summer capital; Nictheroy, the capital of the State of Campos, and other important points.

There is great need in Brazil of telephone service in many parts of the country not reached by the Government telegraph system, or in which the telegraph system does not meet the requirements of business. Although Brazil has 20 States and a territory substantially the same as that of the continental United States, it has no interstate telephone line and, by reason of the interstate restriction, it has few telephone lines serving rural districts within the several States themselves.

According to official returns, there exists in Brazil a total of thirty-nine telephone systems, ranging from 22 to 2503 subscribers, of which, at the time the statistics were prepared, last year, 15 were Berliner, 9 Kellogg, 3 Bell, and 4 "American." The total number of subscribers in all the systems is 9200. Of these companies only five have more than 500 subscribers, viz., Bahia, Rio de Janeiro, Pernambuco, Pelotas and Sao Paulo.

The concern in Rio de Janeiro, the largest in Brazil, is now owned by the American syndicate which has purchased all the public utilities of the city. Since the present owners took charge it has been reëstablished upon a modern basis with American instruments and underground wires. The system has 2676 connections and about 21,000 miles of wire.

The system in Bahia also has recently been purchased by a new concern, which is introducing a modern American system. At the time the statistics were secured it had 554 instruments and about 1400 miles of wire. The Bell system is in use. In Pernambuco the system is Norwegian and German. It has 631 instruments, about 1000 miles of wire, and about as many subscribers as instruments. The system at Pelotas, in Rio Grande do Sul, has instruments of diverse makes to the number of 1479. It has about 2400 miles of wire, and a capital of $180,000.

Mexican Hydro-Electric Developments.

The construction of another large hydro-electric plant, making three in all, will be started by the Guanajuato (Mexico) Power & Electric Company in a few weeks. When completed this plant will give the company about 21,000 available horsepower. The company is composed of Americans who several years ago secured concessions from the Government for the use of the water of certain rivers in the State of Michoacan with which to generate electrical energy. The first of the hydro-electric plants was erected at Zamora. This plant, capable of delivering 8000 hp, was inaugurated in October, 1903, since which time the company, seeing still further need for increasing its equipment to meet the demands of the mining, agricultural and manufacturing interests, has had men in the field securing addition power concessions.

The second plant of the company was built at El Sabino. Concessions for developments on waterfalls of the Angulo River were secured. On the first concession of the company for the use of waterfalls on this river was erected the hydro-electric plant known as the Brunel, which has a head of 50 m, with 7 cu. m of water per second available. A big storage reservoir of 1,000,000 cu. m has been erected at that point. The power houses are built of iron and masonry.

The transmission of the electric energy from the plants to Guanajuato, 102 miles, is unique in that this company was the first to carry its lines on steel towers with long spans, making a decided advance in methods of transmission at high voltage. The energy is carried into Guanajuato at 60,000 volts.

The company has a well-equipped substation at Guanajuato. From here the energy is distributed at 15,000 volts to the surrounding districts, more than 50 miles of distributing circuits being necessary to reach the customers of the plant. Steps are now being taken to construct 30 additional miles of circuits. The company is constantly adding improvements to its great electric transmission system. A different form of tower and longer spans than the ones originally erected are now used. Lightning arresters have also been installed.

The site chosen for the third plant which the company is preparing to erect is seven miles above the Brunel plant. The new hydro-electric plant will have a rating of 10,000 hp, and will be connected with the Brunel plant by a tie line.

The cheap electric energy furnished by the company has been the cause of a remarkable industrial awakening in that part of Mexico. It has led to the development of many mines in the Guanajuato district and has been of great benefit to agricultural and manufacturing enterprises. The energy is used to operate irrigation pumps in the vicinity of La Barca, Leon, Celaya, Irapuato and other places within a radius of 150 miles of the hydro-electric plants.

Electrical Machinery in Australasia.

The important market which Australasia affords for all kinds of electrical machinery is shown by the fact that in 1907 the value of imports into Australia reached the total of $2,051,000. New Zealand imports representing a value of $1,250,000. To the Australian total the British contribution was $975,000; the United States share amounted to $587,000; that of Germany to $136,000, and Sweden $272,500. The competition for the New Zealand market is fierce, and a large share of the business is secured by American and German houses. These are official figures, but there is a probability that some portion of the trade returned as British really represents foreign goods. The new tariff will encourage the local industry in the manufacture of generators and motors, and a new factory has been started to manufacture carbon-filament lamps.

Numerous lighting schemes are in progress and under contemplation in the various States, and there is a good deal of business to be done by American firms in motors and generators, providing they go about the business in the right way. This is peculiarly a business that needs a special representative, with a technical as well as a business training.

The Electric Lighting Committee of Sydney is about to purchase a plant of the total value of $415,000, for which the city electrical engineer has submitted the following estimate: Two 4000-kw generators at $11,000; one 400-kw generator, $13,750; one 400-kw transformer, $2,250; switch gear (at power house), $12,500; crane, $4,250; boilers with superheaters and stokers, five, at $13,000 each; pipe-work valves, feed pumps, economizers, tanks, etc., $36,150; coal and ash conveyor, $5,000; substation switchgear, $5,750. The town of Sunbury, in Victoria, is also about to purchase an electric lighting plant, and one is also about to be installed in Adelaide in connection with a refuse destructor.

There is a good trade being done in electric elevators, and American firms are having it almost their own way save for some competition on the part of Germany. Over 60 were installed in 1907 in Sydney alone. The business to be done in telephones and switchboards is considerable. Here again the bulk of the trade is in American and Swedish hands.

At Auckland harbor, electric capstans are to be installed on some of the wharves, and the facilities for rapid discharge of vessels and handling of cargo will be further increased by the supply of electric cranes, and an 80-ton floating crane of modern type, for which tenders were invited at the end of July last. Wharves and sheds are at present adequately lit with gas, and provision is being made for electric light installation. The wharves at Dunedin also are being equipped

with electric cranes to lift up to 10 tons. With the introduction into Australia of the metallic-filament lamp a fine opportunity is presented for the exploitation of small gas and oil engine sets for electric lighting.

There are various important hydro-electric schemes in the commonwealth, and one of the most interesting, according to Mr. Ben H. Morgan, who recently spent five months in the Antipodes as special commissioner of the Manufacturers' Association of Great Britain, is the Waipori (New Zealand) hydro-electric power transmission scheme, from which energy is obtained to operate the tramway system of Dunedin, and for lighting and general power purposes in that city. Mr. Morgan, in his report, gives some details of the power station as supplied to him by the consulting engineer, Mr. W. G. T. Goodman, now consulting engineer to the Adelaide Tramways Trust. The total value of electrical plant used in the installation is $121,255, of which $41,865 is General Electric Company of America, and $79,360 Westinghouse Company. "It is to be regretted," says Mr. Morgan, "that the large orders involved in this plant should have been placed almost entirely with foreign firms. It should be mentioned, however, that the cables used are chiefly British. The Dunedin City Council has decided to carry out an extension of this scheme that will provide an additional 2000 kw. The estimated cost is $100,000, and manufacturers of electrical and other machinery will do well to place themselves, through their agents, in touch with the city electrical engineer." The evil of the shipping "rings" is emphasized by Mr. Morgan, who says: "The proportional growth of German and American trade as compared with British trade in recent years has been most striking, and the evidence which I have collected . . . shows that this is largely due to the excessive charges and arbitrary conditions of the Shipping Conference."

A Parliamentary Commission, which has been sitting since 1906, has only just issued its report as a blue book, and no doubt a means will be found whereby in the future British exporters will obtain fairer treatment. The difference in rates from Germany or America to Australia as compared with those from Great Britain to Australia is in many lines a profit in itself. On one class of goods Mr. Morgan found a difference of $10 per ton. This, he explains, was exceptional, but it must be remembered that on many lines of goods one-third of this sum will decide the Australian buyer to place his order outside of Great Britain—other conditions being equal.

Electrical Engineers in South America.

Recent consular reports contain some interesting data as to electrical engineers in some of the countries of South America. U. S. Consul-General R. M. Bartleman, of Buenos Ayres, reports as follows concerning the opportunities in the Argentine Republic for the employment of American electrical engineers: "In the installation of tramways, city lighting plants, telephones, etc., the standard of the practising electrical engineer in this country is a high one. Installations of the higher order of engineering, such as first-class elevators, motors in modern offices and hotels, etc., are in their infancy. There certainly is an opening for first-class electrical engineers, as well as structural engineers, and they will be successful if they conform with the customs of the country to a certain extent, but they must remember that electrical and other engineers in Argentina are paid fully 20 per cent less than the usual pay of engineers in New York. The principal difficulty to be encountered by American engineers in getting a foothold in the important constructions lies in the fact that these constructions are almost wholly financed by English, German or French capital, and naturally the important posts fall to the engineers of the countries furnishing the capital."

From Uruguay U. S. Consul Frederic W. Goding, of Montevideo, reports as follows concerning electric systems and plants in Uruguay and the opportunity for American electrical supplies and engineers: "There are three tram systems in Montevideo, two having electricity for motor power, viz.: Sociedad Comercial and Sociedad Transatlántica, and one, Tramvía y Ferrocarril del Norte (horse traction within the city and steam beyond), owned partly by the Uruguayan Government and partly by private parties. In Montevideo there are about 15 electric light plants and several small power plants used in printing establishments. In the outskirts there are several electric light plants, not used in the winter, while there are small electric light plants in half a dozen cities in the interior and about 15 connected with slaughtering establishments. The immense plant used in supplying light to Montevideo, owned by the Uruguayan Government, has recently been very much enlarged, so that now the power generated is sufficient for lighting the city and suburbs, including private lighting, besides furnishing power to all those now using private plants. As the price of the current on Jan. 1, 1909, was reduced from about 26 cents American to 12½ cents per kw-hour, the small plants may go out of use. In the country districts the prices vary from 21 to nearly 26 cents per kw-hour.

"The chief electrical engineer of the Government, an Italian, who is under contract for a term of years and whose position will ultimately be filled by an Uruguayan, receives $620 per month. The resident engineer for the Sociedad Comercial, a Canadian, receives about $350, and the chief engineer for the Sociedad Transatlántica about the same. All the other positions are filled by Uruguayans, with salaries ranging from $50 to $80 per month. The policy of the Uruguayan Government is to send young men to Europe to be trained for electrical engineering, who, on returning to this country, are placed in Government positions. Hence, the opportunities for young men from the United States are limited to times when new works are being erected, as only then are skilled foreigners employed. Such positions have been available, but are now closed, as the new works are practically completed. It is the intention to change the horse tram line to an electric system, and the port authorities eventually will erect electric cranes and install an electric light service along the wharves.

"The general use of electricity as a motive power, as promised by the enlargement of the Government plant, and the great reduction in the price of energy, will lead to the sale of a large number of small electric motors and a vast quantity of electrical supplies. In such a field there appears to be an opportunity for the establishment of supply houses through which a large and permanent business may be built up. It is in that direction that the efforts of electrical engineers from the United States will be most successful."

American Telegraph Systems.

The extent and variety of American telegraph systems is brought out in an advance bulletin summarizing the figures of 1907, just issued by the Bureau of the Census in Washington. A few of these statistics have already been made public. The first table relates to the telegraph systems and is a summary, by class. The total number of systems is given as 1813, of which 25 are commercial land line and ocean cable, 6 wireless, and 625 railroad telegraph systems, the remainder not being involved in the topics treated of herein. The 25 commercial land line and ocean cable systems operated 1,577,961 miles of single wire, employed an average of 28,034 persons, paid $17,808,249 in salaries and wages, expended $41,879,613, earned $51,583,868, and sent 103,794,076 messages. The 625 railroad telegraph systems operated 860,342 miles of single wire, employed an average of 68,197 telegraph operators and dispatchers, expended $37,242,479 (income not stated, as there is no direct financial income from their own use of the service), sent 264,512,816 messages, of which 5,923,483 were of a commercial nature, the income being reported by the commercial systems.

The grand total of ocean cable was 46,301 nautical miles, all controlled by the commercial telegraph systems.

Comparing the telegraph with the telephone system, the grand total of salaried officials, clerks, etc., was 29,470, of whom 25,298 were employed by the telephone systems and 4172 by the commercial telegraph. The telephone officials, etc., received in

salaries $19,298,423 and the telegraph clerks $2,794,937. The total of 142,733 wage-earners is divided, 118,871 belonging to the telephone systems and receiving in wages $48,980,704, while the 23,862 telegraph wage-earners were paid $15,013,312.

The grand total of capital stock and bonds outstanding, par value, was $1,034,909,579, of which $814,616,004 were credited to telephone systems and $220,293,575 to telegraph companies.

The grand total income was $236,045,615, of which the telephone concerns earned $184,461,747, expending $140,802,305, and the telegraph system earned $51,583,868, expending $41,879,613. Of the whole number of systems in operation, the telephone formed 99.9 per cent.

In taking up consideration of the joint subject of commercial telegraphs and ocean cable systems, the bulletin points out the impossibility of segregating the statistics. A comparative summary is given of the three census periods 1880, 1902, and 1907, and it is explained that in 1880 there were 77 companies reported, but that number decreased later by consolidations among themselves. In 1902 there were 25 companies considered. The same number was found for 1907. Taking the details for the last census period, it is shown that 1,577,961 miles of single wire were operated; 46,301 nautical miles of ocean cable; 103,794,076 messages transmitted, which include 5,869,317 cable messages; 29,110 telegraph offices operated; total income, $51,583,868, of which $45,255,187 was from telegraph traffic, and $6,328,681 from all other sources. The total expense was $41,879,613, including $34,057,298 for operation and maintenance, salaries, wages, and legal expenses. The capitalization in the form of capital stock was, authorized, par value, $161,603,900, of which there was outstanding, par value, $155,089,575. Dividends on stock amounted to $7,477,083. The average total number of employees is given as 28,034, and salaries and wages, $17,808,249.

The bulletin notes the decrease since 1880 in the number of separate companies and adds that, on the other hand, there has been a very large increase in business and equipment. The increase in the number of salaried employees and wage-earners in 1907 as compared with 1902 was but 407, or 1.5 per cent. As compared with 1880, the number was 13,106, or 87.8 per cent increase. In 1907 the amount paid in salaries and wages was 18.4 per cent greater than in 1902, and 264.5 per cent greater than the 1880 figure.

The commercial telegraph systems controlled ocean cables having a length of 46,301 nautical miles in 1907, as compared with 16,677 in 1902, an increase of 29,624 nautical miles, or 177.6 per cent. It is pointed out that this large increase is largely due to the fact that the Pacific cable and the New York-Havana cable were laid during the interval between the two censuses.

There were six commercial wireless telegraph systems, having 122 tower stations in 1907, situated at most of the large ports on the Atlantic and Pacific oceans, the Gulf of Mexico, the Great Lakes, and in Hawaii. Wireless messages to the number of 163,617 were sent between these ports in 1907. These six companies had an authorized capitalization in the form of stock with a par value of $39,450,000, of which $32,726,242 was the value of outstanding stock. The year's income was $122,154, and the expenses $169,782, of which $87,571 was expended in the salaries and wages of 182 employees.

It is pointed out that the Federal Government has realized the value of wireless telegraphy, and the Bureau of Equipment in the Navy Department, at the end of the fiscal year 1907, had installed wireless telegraph apparatus on 73 naval vessels and at 44 shore stations. During that period the shore stations sent 26,933 messages, containing 541,919 words, and received 34,073 messages, amounting to 675,607 words.

In 1907 the railroad systems in the United States operated 807,824 miles of telegraph wire, 52,518 miles of telephone wire, and employed 68,197 telegraph operators and dispatchers, who received $37,242,479 in salaries and wages. These systems reported 33,441 telegraph offices and 30,115 telephones; transmitted 5,923,483 commercial messages and 258,589,333 messages in connection with the dispatching of trains and other railroad business.

Industrial Electrical Installations at Cobalt, Ontario.

In all commercial enterprises one of the most important questions to be taken into consideration is that of motive power, and any means that can be used to cheapen the cost are eagerly taken up by the consumers. This is particularly true of the Cobalt district, where several companies have been formed to supply air and electricity on a large scale to the mines at a price that will mean an immense saving to the consumers. An exhaustive series of tests were made at the different power plants at the mines, and it was found that the average cost was about $175 a hp-year. The most economical plant produced power for $125, and there were found cases where the cost ran up to nearly $400 per year. This high cost is largely due to the price of coal, which will average about $5.50 a ton on the cars at Cobalt, and as all the coal has to be hauled in carts from the cars, the average price at the mines is well above $6 a ton.

Of the companies installing the large power plants none is creating more interest than the Mines Power, Limited. This company has been financed by Montreal capitalists, and as all the money has been raised by the promoters themselves there is no stock or bonds on the market. The president is Mr. E. A. Wallberg, and Mr. F. John Bell is the general manager. The company is capitalized at $3,000,000.

The plant is being installed on the Matakichewan River, close to Lake Temiskaming, and about 25 miles from Cobalt, where there is a large water-power available. The Government has also granted the company the right to dam up the waters of the lakes, drained by the river, thus enabling the company to provide sufficient storage-capacity in case the water in the river should fail.

The main dam above the power house is being constructed throughout of solid concrete and it will be 800 ft. long and 45 ft. high when completed. Two 5-ft. steel penstocks will be used to conduct the water to the wheels. The working head is 312 ft. and it is estimated that a total of 15,000 hp can be developed.

The power house, which will also be built of concrete, is 40 ft. x 90 ft., and will be fitted with traveling cranes to facilitate handling the heavy pieces of machinery. Four separate generating units are being installed, but ample provision has been made for extensions to the power house equipment. It is expected that this equipment will be sufficient for the present requirements of the camp. Each generator is rated at 1875 kw with a large overload range and is a three-phase, 60-cycle, 2300-volt machine. The wheels are Swiss-type, spiral case turbines with a rating of 2750 hp. These will be directly connected to the generators. There are to be two exciter units each of 100-kw rating and directly connected to a waterwheel. High-power governors are being put in to insure perfect regulation. The step-up transformers will increase the pressure from 2300 volts to 44,000 volts, and there will be four in continual use, while another one will be on hand to be used in case of an accident.

Two separate transmission lines are being built, each having a separate circuit. These are placed 25 ft. apart, and although they will both be in continuous service, the whole of the power can be carried over either line in case of an accident. Aluminum is being used for conductors and these will be supported by high-tension porcelain insulators. The right of way through the bush is being cut 100 ft. wide and to further insure the safety of the wires, all high trees have been cut on both sides in close proximity.

For the delivery of energy to the mines, three substations will be built; one in South Lorraine, with an equipment of 1000 hp, one in the Kerr Lake district of 2500 hp, while the remaining output of the plant will be used in the station at Cobalt. The station equipments will consist of three-phase, step-down transformers, with the usual lightning arrester and switchboard equipment. The distributing e.m.f. will be 2200

volts. At the Kerr Lake and Cobalt stations there will be central plants for the distribution of compressed air. At Cobalt this will consist of three directly connected, motor-driven, three-stage air compressors, each having a rated capacity of 4200 cu. ft. of free air per minute. The compressors will have extra large inter-coolers and after-coolers. The air will be delivered at 100 lb. pressure and approximately atmospheric temperature, through radiating pipe lines from the central station to the surrounding mines, and will be sold to the consumer on a meter basis.

The work on the plant is being vigorously pushed, and it is expected that the company will be in a position to supply electricity by the end of September and air a month later. The dams are being built on the upper lakes, and 400 men are engaged in the construction of the power house and concrete dam. Three separate gangs of men are at work cutting the right of way and erecting the transmission lines. The plant as a whole consists of practically duplicate units, and the management is taking every precaution to insure a continuous delivery of energy.

This company also intends to extend its transmission lines into the newer districts of Elk Lake and Gow Ganda. It also has control of the Kakake water-power on the river Quinze, from which can be developed 40,000 hp. This will be held in reserve to be developed as the market extends.

Electrical Problems Discussed by Automobile Engineers.

A distinguishing feature of the summer convention of the Society of Automobile Engineers, held in Chicago on Aug. 5, 6 and 7, was the large proportion of papers presented which were of an electrical nature. The society is five years old and has about 300 members. It occupies a relation to the automobile industry similar to that of the American Institute of Electrical Engineers in the electrical industry. It holds its annual conventions in New York in January of each year during the automobile show and has three or four other meetings annually, including a regular summer convention. These summer conventions have been held in Buffalo, Cleveland and Detroit, and at the one of this year the society paid its first official visit to Chicago. The officers of the society are: President, Mr. Henry Hess, Philadelphia; first vice-president, Mr. Russell Huff, Detroit; second vice-president, Mr. B. D. Gray, Providence, R. I.; treasurer, Mr. A. H. Whiting, New York; secretary, Mr. A. Churchward, New York; managers, Messrs. David Fergusson, of Buffalo; H. G. Chatain, of Schenectady; H. M. Swetland, of New York; F. J. Newman, of Chicago; R. C. Carpenter, of Ithaca, N. Y.; A. L. Riker, of Bridgeport, Conn., and T. J. Fay, of New York. The officers and managers constitute the council. The arrangements for the Chicago convention were in the capable hands of Mr. F. J. Newman, the local member of the council. The attendance was not large, but the papers and discussions were of a high order.

On Thursday, Aug. 5, members of the society and visitors assembled at the Illinois Athletic Club, Chicago. This day was devoted to the hill-climbing contest at Algonquin, Ill., the entire party proceeding to that village in cars loaned by local dealers. The Babcock car won the event for the electrics, beating the Columbus car, which was the other electric entry. The record was lowered by both cars, and both bettered the time made by some of the gasoline cars—a fact that should be of interest to central-station men who are faint-hearted in relation to the use of electric cars in hilly country.

The first business session was held on Friday morning at the Illinois Athletic Club, with President Hess in the chair. After some routine business had been transacted the first paper was presented by Prof. R. C. Carpenter, of Cornell University, who described efficiency tests made on a Pierce six-cylinder, water-cooled gasoline motor. The speaker illustrated his remarks by lantern-slide diagrams. He said that he preferred the electric dynamometer for tests, although it had not been used in the investigation under description. He described the manograph, an instrument used in the tests for making indicator diagrams. This is a photographic instrument, in which use was made of an electric lamp of an improved arc type devised for the tests at Cornell. In concluding his remarks the speaker said that the gasoline motor is an efficient machine and is practically as efficient in the small sizes used on motor cars as in those employed in large stationary practice.

STORAGE-BATTERY PAPERS AND DISCUSSIONS.

Dr. Edward Sokal, a consulting chemical engineer, of Chicago, read the second paper, entitled "Possible Increases of the Weight Efficiency of Storage Batteries." He began by saying that the problem of producing a storage battery to have a greater output per unit of weight is as old as the history of the storage battery itself. He considered the various possibilities of improvement in this direction. In his opinion the possibility of obtaining a practical advantage by using a different chemical material than the lead battery is practically negligible. Dr. Sokal criticized the Edison storage battery. He said that the utmost limit which has been obtained by Mr. Edison, so far, is about 11 watt-hours per pound of element—a figure which can be easily exceeded by the lead storage battery. The attitude of most electrochemists toward storage batteries other than the lead cell is one of great skepticism. There has been no really fundamental progress since the days of Planté and Faure. However, the progress which has been made in the art of manufacturing and operating storage batteries since the principle was discovered has been very considerable; it has been the slow, gradual work of improvement rather than anything like a startling revelation.

Variations of design may have a marked effect on the output per unit weight of the lead storage battery. For instance, while the standard storage-battery cells of this country are kept within 9 to 12 watt-hours per pound of total element, cells are made in Germany which reach an output of 17 watt-hours per pound. The electric-vehicle manufacturers in Germany use exceedingly thin plates which are not considered advisable under the conditions obtaining in this country. Both the porosity and the thickness of storage-battery plates have an appreciable influence on the specific output, but Dr. Sokal did not care to go on record as advising generally the use of thin plates; the manufacturer has in each particular case to form a decision which will necessarily be in the nature of a compromise, as it is obviously impossible to unite all advantages in one type.

Attention was called to one way in which it may be possible to obtain quite an appreciable gain of output for the same weight. In the present vehicle battery the negative electrode has a much greater specific output than the positive, and in the elements the number of negative plates always exceeds the number of positive plates by one. But the speaker contended that, in vehicle batteries, it is usually not the negative but the positive plate which is the weak spot and which fails first. He therefore proposes to build vehicle cells having the positive and negative plates so divided that there will be one more positive than negative. He said that with this arrangement he has constructed elements showing 10 to 15 per cent increase in specific output, but the practicability of the suggestion may be affected by further experiments.

At considerable length the speaker went on to show that lack of electrolyte of suitable concentration in the pores of the active material is really the reason for the poor specific output of the lead storage battery. He concluded by announcing that he had been working on the problem of producing a storage battery in which the concentration of the electrolyte within the pores of the electrodes is kept constant by causing a continuous flow of the electrolyte through the pores of the active material by pressure or similar means. Dr. Sokal said that he has succeeded in overcoming the difficulties in the way of artificial circulation of the electrolyte by constructing shallow or bottle-shaped electrodes, through the walls of which the circulation takes place. In this way, he said, a gain in specific output of from 50 to 100 per cent may be obtained.

Mr. H. M. Beck, of the Chicago office of the Electric Storage

Battery Company, presented the third and concluding paper of Friday's session. The paper is entitled, "Some Points in the Operation and Care of Vehicle Batteries," and it is of practical value. Mr. Beck said there are four points of special importance in caring for a storage battery—namely, the battery must be charged properly, it must not be overcharged, short-circuits between the plates or from sediment under them must be prevented, and the plates must be kept covered with electrolyte and only water of the proper purity used for replacing evaporation. The points to be especially emphasized in connection with charging are that on regular charges keep the rates as low as practicable and cut off the supply promptly; it is preferable to cut off a little too soon rather than to run too long when there is any doubt. Overcharges must be given at stated intervals and continued to a complete maximum. They should be cut off at the proper point; when in doubt it is safer to run too long rather than to cut off too soon.

In relation to the mercury ampere-hour meter to show the charge and discharge of a storage battery, the speaker said that the results obtained thus far with this instrument have been very promising.

One practical suggestion related to the "washing" of batteries for sediment: There have been many complaints of lack of "capacity" from batteries after washing. Almost without exception this accusation is due to lack of a complete charge following the cleaning. When reassembled the plates need a very complete charge, and unless this charge is given the cells will soon give trouble. "Flushing," or replacing evaporation in cells with electrolyte instead of water, is a common mistake. Mr. Beck discussed at some length the treatment required for bringing a "low" cell or battery back into shape.

On Friday afternoon the visitors were taken to Pullman, where they inspected the extensive works of the Pullman Company.

Saturday morning's session concluded the convention. It was held amid the pleasant surroundings of the South Shore Country Club, and, looking up from the tap-room, where they were seated, the delegates could gaze out over Lake Michigan. A large part of the session was devoted to discussion of the two storage-battery papers, and considerable attention was paid to the question of using ampere-hour meters. Mr. Ernest Lunn, of the Commonwealth Edison Company, Chicago, was the first speaker. He said that Dr. Sokal's paper will bear a careful reading, and that some of his predictions may be adopted in the future. The suggestion about an additional positive plate may work out to advantage. Referring to the ampere-hour meter mentioned in Mr. Beck's paper, the speaker said that this instrument is not a cure-all for the ills that batteries are heir to, but it has manifest advantages. It enables the driver to ascertain how much of his battery charge is left; it prevents lazy drivers from misrepresenting the amount of energy left in the battery; it gives the best kind of a check on battery charging, and enables the private owner to determine whether he is getting the full charge he pays for at public garages. Mr. Lunn said, referring to another part of Mr. Beck's paper, that the utmost care should be taken in assembling elements of batteries. Owners of both pleasure vehicles and commercial wagons cannot afford delays in operation.

Mr. A. Churchward, of the General Electric Company, New York, did not agree with Dr. Sokal's criticism of the Edison storage battery. He said that he had used one of these batteries for seven years, and has been obtaining considerably over 11 watt-hours per pound of element out of it. The new Edison cells give over 16 watt-hours per pound of element.

Mr. F. J. Newman, of the Woods Motor Vehicle Company, Chicago, said that electric-vehicle troubles are often caused by drag or lack of axle alignment. In commercial vehicles and others using hard-rubber tires, it can often be determined whether the axles are out of alignment by observing how the tires wear. If the axles are out of alignment, the tires will wear on one side. Referring to the ampere-hour meter, Mr. Newman said that it is an old device. There are two types. One records on discharge, and in the other the discharge travels at a faster rate than the charge and is compensated for. The speaker was afraid that if ampere-hour meters are used, vehicle owners will get into difficulties because the instruments can be tampered with. In commercial service they are unnecessary, for a hydrometer will do the the work. If batteries are not in proper condition the ampere-hour reading will be misleading.

Mr. H. H. Rice, of the Waverly Company, Indianapolis, complimented Mr. Beck's paper. He was especially gratified that the society had two papers on electric storage batteries. The electric vehicle affords very interesting problems. It is simple in its essentials, but in case of trouble it needs attention from somebody who understands it. It is certain that the electric vehicle has a place in the automobile world. It should not be purchased to do gasoline "stunts"; on the other hand, a gasoline machine should not be used if an electric car will give the service desired. The speaker expects to see improvement in the storage battery, but he remarked that the electric car of today has all the mileage it needs for city and suburban purposes.

Mr. Wilton Bentley, of the Universal Electric Storage Battery Company, Chicago, referring to the specific-gravity test of batteries, said that it requires considerable time and space. Mr. Lunn's point about the ampere-hour meter being a check on lazy drivers is an important one. The conscientious driver can increase the mileage of a vehicle by perhaps 100 per cent. No doubt the instrument can be locked in such a manner that it cannot be tampered with. It is not likely that anything except some mechanical defect will reduce the "capacity" of the battery between charges. If a battery has a certain "capacity" one day, it will have about the same the next day. Mr. Bentley believes in the usefulness of the ampere-hour meter.

Mr. Scott Van Etten, of Elkhart, Ind., said that the storage batteries in vehicles are abused and neglected. There is a tendency toward the gradual formation of white sulphate of lead, one of the several sulphates encountered in storage-battery work, and this produces a false specific gravity, which interferes with the usefulness of the hydrometer test. The ampere-hour meter has its limitations, but Mr. Van Etten believes that it will be a valuable adjunct to the electric rig.

Mr. Beck remarked that if the battery falls behind, the fact must show in the specific-gravity test. He should say that, for this purpose, a specific gravity test would be superior to the ampere-hour test.

Mr. J. F. Firestone, of the Columbus Buggy Company, Columbus, Ohio, said that in 9 times out of 10 trouble with electric vehicles is due to shortage of water in the batteries, as Mr. Beck intimated in his paper. At other times all that is needed is a little air in the tires. Many ladies watch the condition of their electric machines very carefully. It is the simple forms of neglect which cause the great majority of common troubles.

Mr. Newman thought that the difference in sulphates to which Mr. Van Etten alluded is probably the difference in crystallization. There can be no false specific gravity. The speaker explained the chemical action of the battery to substantiate this statement. The voltmeter furnishes the only way to show from an external source such mechanical injuries as broken jars, loose terminals, etc. It is not difficult to arrange a pilot cell for the hydrometer test, which is simple and requires little apparatus to complicate matters.

Mr. Van Etten said that when the average garage man gets a low gravity reading, he proceeds to flush his battery, which is usually a bad thing to do.

Mr. Lunn, speaking from practical experience with the ampere-hour meter gained by six months' use on 15 vehicles, said that he had yet to find the first case of trouble with this instrument, which has not proven in any way misleading. With its use vehicles never get stalled for lack of energy. The gravity test must not be neglected, but the ampere-hour meter is very useful.

Mr. Beck, in closing the storage-battery discussion, said that his position in regard to the ampere-hour meter was that of one who holds a middle ground. The instrument is a help, a step in the right direction, but it must not be thought that it

will take the place of everything else. The gravity test in reality is an ampere-hour reading, but the ampere-hour meter gives nearly the same information, and is very convenient. The speaker wanted to emphasize the fact that ammeters and voltmeters must not be taken off electric vehicles because the ampere-hour meter is used. The latter is a good thing, a decided help, but it does not furnish all the help which operators of electric vehicles should have.

OTHER PAPERS AND DISCUSSIONS.

After a brief discussion on Professor Carpenter's paper on the testing of the six-cylinder gasoline engine, Mr. Frank H. Floyd, of Detroit, read a paper on lubricating oils. One of his points of general interest was that large users should purchase their oils under specifications, to be followed by test, just as they do other materials.

"Energy Consumption of Commercial Vehicles" was the title of a short paper read by Mr. Alexander Churchward. This is a practical paper containing data showing that the horse-power required by a vehicle is influenced by a number of factors, the principal ones being tires, controlling apparatus, transmission losses, correct gear ratio, wheel diameter, springs, road resistance, grades, wind resistance, economic speed, stops, and acceleration. In discussing this paper Mr. Lunn said that Mr. Churchward's table of economic speeds is particularly valuable. It is not advisable to attempt to run a commercial vehicle ordinarily above its economic speed; speed mania ought not to influence commercial-vehicle operation. Mr. Newman gave some interesting information about tires, describing their composition and the methods of manufacture. He also spoke of the desirability of calculating a formula of power consumption for automobiles if this could be done. In closing the discussion on this paper, Mr. Churchward noted the comparatively great acceleration of the electric car compared with the gasoline car.

Mr. H. S. Baldwin's paper on "Electric Cradle Dynamometer" was read by Mr. Churchward in the absence of the author. This paper described the electric cradle dynamometer in which an electric generator is used for loading the gasoline engine under test. This dynamometer is of the absorption type, but the load is dissipated in a suitable rheostat at any desired distance from the dynamometer, which reaches only a moderate temperature. The apparatus was described particularly from the viewpoint of testing gasoline engines.

After some other discussion the convention was adjourned. The delegates were entertained at luncheon at the South Shore Country Club by the Woods Motor Vehicle Company and spent the afternoon in playing golf and indulging in other outdoor recreations.

New York Public Service Commission News.

The Public Service Commission of the First District of New York held a public hearing on Aug. 11 upon the application of the receivers of the Metropolitan Street Railway for permission to purchase 500 shares of the capital stock of the Bridge Operating Company from the receiver of the New York City Railway Company. The application set forth, that under the agreement between the city of New York, the Brooklyn surface lines and the New York City Railway, the city should construct the surface tracks across the Williamsburg bridge, that the Manhattan company should operate the northerly part of the tracks for a 5-cent fare, that the Brooklyn companies should operate over the southerly tracks for a 5-cent fare and the Bridge Operating Company should operate local cars for a 3-cent fare. The receiver of the New York City company, being without operating facilities, desires to sell his interest in the local operating company to the Metropolitan, which has equipment. No decision has been rendered as yet upon the question.

An order has been adopted by the Public Service Commission authorizing the Spuyten Duyvil & Port Morris Railroad Company to assume the bonds to be issued by the New York Central to the amount of $2,500,000, bearing interest at 3½ per cent. The commission also approved an application of the Spuyten Duyvil road permitting it to issue a mortgage of $20,000,000 upon its property.

The commission has set a hearing for Sept. 8 upon the question whether extension of the proposed rapid transit line from Buffalo Avenue to New Lotis Avenue on Eastern Parkway, in Brooklyn, shall be constructed under the plan of assessments upon the area benefited as authorized by the Travis-Robinson bill.

The commission has held a public hearing during the past week for the purpose of determining the character, extent and value of the property of the Third Avenue Railroad Company. This hearing is a preliminary step in the consideration of the reorganization plan of the Third Avenue Company which has been proposed by Receiver Whittridge.

Frederick W. Whittridge, receiver for the Third Avenue Railroad Company, has applied to the Public Service Commission for a franchise over the Queensboro Bridge. The route will start from Fifty-seventh Street and Third Avenue and cross the bridge to Jackson Avenue in Long Island City. It is proposed to issue free transfers from the Third Avenue line.

It is announced by the Public Service Commission that plans are being prepared for approval by the Board of Estimate, of an addition to the Broadway-Lexington Avenue subway route which will provide for a west side line to form a connection with the new Pennsylvania Railroad terminal at Thirty-third Street and Seventh Avenue.

The Public Service Commission, Second District, gave a hearing at Albany, Aug. 10, on the application of the Geneva-Seneca Electric Company for authority to execute a mortgage for $500,000 and to issue at present $360,000 in 5 per cent bonds.

On Aug. 11 the commission gave a hearing to the reorganization committee for the approval of a plan for the reorganization of the Albany & Hudson Railway Company, and the issue of stocks and bonds of a company to be formed on this plan.

On Aug. 12 the petition of the Plattsburg Light, Heat & Power Company and the Lozier Light & Power Company for consent to merger and consolidate will be given a hearing.

The commission has authorized the Lewiston & Youngstown Frontier Railway Company to construct an extension of its railroad in Oneida Street in the village of Leiston.

CURRENT NEWS AND NOTES.

RADIUM ON THE FREE LIST.—The new tariff law especially mentions radium as one of the articles placed upon the free list. There was no mention of radium in the Dingley bill, as it was unknown at the time that law was approved.

EMERGENCY LIGHTING AT BARCELONA, SPAIN.—During the recent rioting at Barcelona, the gas and electric lighting plants being out of commission, the city was lighted by means of the search lanterns on the warships in the harbor.

COMPLETION OF NEW TRANSATLANTIC CABLE.—The Commercial Cable Companies has completed the laying of its new cable from St. John's, N. F., to New York. The landing has been made at Manhattan Beach and the line is now in service. The new line to Newfoundland is 1307 miles long and the line across the ocean taps the main line 270 miles east of St. Johns. It is claimed that the new line will vastly increase the speed of transmission.

BALLOONS STOP TROLLEYS.—An item from St. Louis of Aug. 9 says: "The East St. Louis & Suburban Railway Company has declared war on balloons. Several of the company's cars have been tied up because guide ropes trailing to the ground from balloons became entangled with trolley wires and put the cars out of business temporarily. The company will hold the balloonists responsible for damages and time lost when the air craft tie up trolley cars."

A NEW TARIFF.—The Payne tariff bill was agreed to by the United States Senate on Aug. 5, and became law the same day, President Taft signing it and making a brief statement in support of its right to be regarded as "revision downward." A summary of the various portions affecting the electrical industry appeared last week in our Aug. 5 issue.

ELECTRIC VEHICLE EXPERTING.—The Edison Electric Illuminating Company, of Brooklyn, N. Y., has started a new campaign to develop the electric vehicle field and to increase its vehicle "load." It has secured the services of an expert battery and vehicle engineer and letters have been written to every electric vehicle user in Brooklyn offering them his advice free of charge.

PENNSYLVANIA ELECTRIC ASSOCIATION.—The Pennsylvania Electric Association will hold its second annual convention at Eagle's Mere on Sept. 8, 9 and 10. An interesting program is being provided by Mr. J. H. Perkins, chairman of the program committee, who states that a very large attendance is expected.

CONNECTICUT UTILITIES BILL.—The Connecticut House of Representatives has voted against the Chandler Public Utilities Commission bill, which the Senate had rejected in favor of the majority report known as the Barnum bill. The Barnum bill provides for a commission of three to supervise gas, electric and telephone companies, while the Chandler bill calls for supervision of all public-service corporations, including the New York, New Haven & Hartford Railroad.

LOST RADIUM PACKAGE.—Dispatches from Paris state that the city is excited over one of the most curious cases of loss ever known. A gentleman left on a seat in an omnibus a tiny package valued at $5,000. The peculiarity of the package is that it is a tube containing salts of radium. No infernal machine was ever so frantically sought as this tiny tube by the Paris police. All the omnibuses were searched and swept, and urgent warnings were posted in public places.

WIRELESS RATES.—In connection with the recent completion of a wireless telegraph station at the port of Willemstad, Island of Curacao, it has been announced that the following rates will be charged: From 1 to 10 words, 40 cents; for every additional word, 4 cents; delivery of message in Willemstad, 10 cents; delivery on board of a vessel not moored alongside the quay of Willemstad, 20 cents. These charges are collected from the sender or receiver of the message on land while the ship rates charged on board of the vessel are paid by the sender or receiver on board.

ELECTRICALLY OPERATED DRAINAGE CANAL BRIDGES.—The Sanitary District of Chicago will operate by electricity the Western Avenue and eight-track bridges across the main channel of the Drainage Canal near Thirty-first Street. Use will be made of a rotary converter capable of delivering 100-kw, direct current, at 550 volts. The electricity furnished to the alternating-current side of the machine will be 60-cycle, three-phase, at the required voltage. A two-panel marble switchboard, with starting controller, circuit-breaker, rheostat, instruments and switches, will also be installed.

RESTRICTION ON POWER DEVELOPMENT.—Attorney-General Mullen, of Wyoming, has brought suit for the State against the Big Horn Power Company, asking the removal of part of the dam in the Big Horn Canyon. The dam is claimed to exceed the specifications approved by the State engineer, by the erection of a bridge and buttresses above the 35-ft. dam. The Burlington Railroad is the principal complainant on the ground that the additional structure blocks its new construction for three miles along the canyon. An injunction will be sought restraining the power company from closing the gates.

CIVIL SERVICE EXAMINATION FOR POWER PLANT ENGINEER.—The Navy Department announces an examination of applicants at the Federal Building, Chicago, Aug. 24, for the purpose of filling the positions of engineer in charge of power plant, at $5.04 per diem, and assistant engineer, at $4 per diem, at the United States Naval Station, Great Lakes, North Chicago, Ill. Detailed information concerning the examination is contained in Examination Order No. 34, a copy of which can be obtained from the Commandant, Naval Training Station, Great Lakes, North Chicago, Ill.

SOUTH AMERICAN EXPOSITIONS.—The railway exposition at Buenos Ayres in commemoration of the centenary of independence of the Republic will offer, it is said, unusual opportunities for American manufacturers of railway material and machinery of all kinds, and the date for receiving applications has been extended until Sept. 1. The proposed exposition at Santiago, Chile, this year has been postponed until the spring of 1910, and Consul A. A. Winslow, of Valparaiso, writes that it will be of great value to American interests, the field including electrical and industrial apparatus of all kinds.

WIRELESS INSURANCE.—It is reported from Berlin, Germany, that steamship companies using wireless apparatus on their vessels will apply for lower insurance rates. A proposition to this effect will be presented to the international marine insurance congress at Baden-Baden beginning Sept. 8. It will be supported, it is understood, by President Arthur Dunker, head of the North German Marine Insurance Society, and by representatives of various foreign organizations. The adoption of this plan, it is urged, will result in extending the use of the wireless system aboard ship throughout the world and in a consequent reduction of the number of accidents.

THE DINNER TO EDISON.—The annual convention of the Association of Edison Illuminating Companies will be held at Briarcliff, N. Y., Aug. 31 to Sept. 3, inclusive, under the presidency of Mr. W. W. Freeman, of Brooklyn, N. Y. One of the distinguishing features will be a dinner given in honor of Mr. and Mrs. Thomas A. Edison on Thursday evening, Sept. 2. On this occasion the association will entertain the guests of honor, who will meet the members of the association and guests composed mainly of those who were pioneers in the Edison electric-lighting industry in the early eighties. The committee in charge of the arrangements for the Edison dinner consists of Mr. Samuel Insull, of Chicago, chairman; Mr. Charles L. Edgar, of Boston, and Mr. John W. Lieb, Jr., of New York. The convention already promises to be one of the largest ever held by the association, and it is an interesting coincidence that it is alike the thirtieth convention and the thirtieth annivery of the Edison lamp of 1879.

CONSERVATION CONGRESS.—A very large attendance is expected at the first National Conservation Congress, which is to be held at the Seattle Exposition, Aug. 26, 27 and 28. The delegates will include United States Senators and Representatives, Cabinet officers, the Governors of many States, members of 40 State Conservation Commissions, mayors of cities, and delegates from commercial and civic organizations. Delegates are coming from Alaska and the Hawaiian Islands. Prof. Ralph S. Hosmer, of the Hawaiian Conservation Commission and Gov. W. T. Freer are among those who have promised to attend. West Point will be represented by Gen. Marion P. Maus, commanding the Department of the Columbia. Addresses will be made by R. A. Ballinger, Secretary of the Interior; Gifford Pinchot, chairman of the Joint Committee on Conservation Between States and Nation; W. K. Kavanaugh, of the Lakes-to-the-Gulf Deep Waterways Association; James Arbuckle, secretary of the Latin-American and Foreign Trade Association, and Howard Elliott, president of the Northern Pacific Railway Company. The conservation movement will perfect a permanent organization at the Seattle Congress. It will also select representatives to attend the World's Conservation Conference at The Hague.

A ROUNDABOUT ALARM OF FIRE.—An alarm of fire from the northern part of Edwardsville, Ill., was sent over 200 miles recently and returned to a point 10 blocks away in three minutes. A crew in a tower of the Wabash Railroad at Edwardsville Junction reported to the agent at the station that a car of coal had caught fire. There is no telephone in the yard station, so the agent notified the superintendent's office at Decatur, 100 miles away, by wire. The dispatcher called Poag, the nearest station to Edwardsville which has a long-distance telephone. The Poag operator notified the exchange at Edwardsville and the operator there rung the alarm in the engine house. Three minutes from the time the fire was reported the apparatus was on its way.

GASOLINE-ELECTRIC CAR IN CHICAGO.—Considerable attention was attracted on Aug. 2, among railroad and electrical men in Chicago, by a gasoline-electric passenger car of the latest type developed by the General Electric Company. This car was on exhibition at the passenger station of the Chicago, Rock Island & Pacific Railway Company, of Chicago, and has seen actual service on the Southern Railway, between Manassas and Strasburg, Va. These places are 63 miles apart, and for 20 days the car made a round trip daily. The Atchison, Topeka & Sante Fé Railway Company is testing a similar car of the same make. Both cars have made trial trips around Chicago. A complete description of the car and its equipment appeared in the May 27 issue.

ELECTRICITY FOR IRRIGATION.—The United States Sugar & Land Company, of Garden City, Kan., has contracted with the farmers about Portales, Roosevelt County, N. M., to install a steam-engine generating plant at Portales which will furnish energy to centrifugal pumps for irrigation throughout the district. Between 10,000 and 12,000 acres are to be irrigated by pumping from an underflow which is close to the surface. The land is in the artesian belt in the eastern portion of New Mexico, where the artesian level is below the surface of the ground. Hundreds of farmers have signed the contracts, considerably exceeding the minimum area of 6000 acres required by the company before proceeding with the construction. Use will be made of New Mexico coal as a fuel.

THE CLEVELAND TROLLEYS.—By a very decisive vote, the people of Cleveland, headed by a committee of 100 leading citizens, have rejected the Johnson plan under which there would be a 3-cent carfare and a gradual absorption of the franchises of the Cleveland Railway Company. It is now most probable that the plan of Federal Judge Tayler for a careful revaluation of the properties with a 3-cent fare, and 1 cent for a transfer, will be adopted, it being provided that if the dividend or the valuation falls below 6 per cent, the rate of fare may be raised to 25 cents for seven tickets. Before the Johnson-Schmidt scheme, now defeated, was put forward, an attempt was made to pass such a Tayler ordinance, but it failed. There is now more likelihood of success, as the public wants the question settled and taken out of politics.

RENDERING WIRELESS SIGNALS SELECTIVELY AUDIBLE.—A patent granted to Mr. J. H. Cuntz, on July 13, describes a method by which selectivity in wireless telegraphy can be obtained by the use of acoustic instruments. By means of a mechanical interrupter in the sending circuits, with which a tuning-fork is magnetically associated, the high-frequency wireless telegraph current is interrupted throughout each signal period at a definite rate corresponding to the pitch of the tuning-fork. A tuning-fork magnetically associated with the receiving circuits gives forth an audible sound when the wireless signals are interrupted at the rate corresponding to its pitch. Hence, the selectivity depends solely on the vibrational periods of the tuning-forks at the sending and receiving stations, the signals being heard only when the forks at the two stations have equal pitches.

FRENCH LETTER REGISTRY.—The United States Postoffice is considering plans for overcoming the deficiency in the expenses of registering letters. The fee is now 8 cents. Meantime advices from Paris state that the French Government has just introduced into use an ingenious automatic device for registering letters. The letter is dropped into a box, and a nickel piece, purchasable for 5 cents, placed in the slot. The crank is turned, a numbered receipt falls out, and the corresponding number is stamped on the letter. The ingenious feature of the machine is the device for preventing the use of any except the nickel coin. This is accomplished by means of a magnet. The slight attraction of the nickel is neatly calculated, and as the coin falls the attraction is just sufficient to retard it and make it fall into the pocket which operates the mechanism. An iron piece would be strongly attracted, miss the pocket and be ejected. All other coins also are ejected.

SPLIT-PHASE MOTOR.—A method of obtaining two windings of different inductive time-constants for use with a single-phase induction motor as a split-phase machine is described in a patent recently issued to Mr. S. R. Bergman. The stator is arranged with open slots, the main winding being placed in certain of the slots and the starting winding in the remaining slots. Magnetic wedges are employed to close the slots occupied by the main winding, and non-magnetic wedges for the slots containing the starting winding. Since the starting winding is wound with smaller wire than the main winding and is placed in the tops of the slots, the bottoms of the slots being filled with pieces of wood or other non-magnetic material, thereby decreasing the reactance of the starting winding, by this arrangement the main winding is of high reactance and low resistance, while the starting winding is of low reactance and high resistance, and yet the slots of the stator are of uniform size and equally spaced.

MONT BLANC ELECTRIC ROAD.—The electric railway up Mont Blanc was started on Sunday, July 25, and the first section is now open to the public, which is now able to ascend to the Col de Voza, 5495 ft. high. The first train up took an hour to accomplish the journey of about four and one-half miles. There are no tunnels, and the steepest grade is 20 ft. in the 100. Some magnificent views of Alpine scenery can be had from the cars. Having accomplished the first stage of the journey up Mont Blanc, the plan is to continue along the ridge of the Col de Voza, tunneling through first the Aiguille and then the Dôme du Goûter, coming out by the Observatoire Vallot. From there a tunnel will have to be made right underneath the Bosses du Dromadaire, into the heart of Mont Blanc, and then the summit is to be reached, as in the case of the Jungfrau, by means of a lift. This is the plan for the continuation of the line, and it has even been calculated that the cost of the return ticket is to be $20.

OUTING OF CONSTRUCTION DEPARTMENT OF COMMONWEALTH EDISON COMPANY.—About a thousand persons, including women and children, attended the annual outing of the construction department of the Commonwealth Edison Company, of Chicago, at Glenwood Park, Batavia, Ill., on the afternoon of July 31. The merrymakers, who proceeded to the park on the Aurora, Elgin & Chicago Electric Railway, filled 15 large cars. The feature of the afternoon was a baseball game between nines representing the station construction men and the interior wiring force for a prize of $10. This was an exciting game and was won by the station construction players after a seven-inning contest by the score of 11 to 10. The feature of the game was the prowess of Mr. A. C. Jantzen, who made two home runs and a three-base hit for the station construction team. There were foot races for the married ladies, the single ladies, the married men, the single men, the girls and the boys, and in the evening there was dancing in the pavilion. The outing was thoroughly enjoyed. Its success was largely due to the efforts of a committee of arrangements consisting of Messrs. H. C. Patterson, chairman; J. C. Manley, E. H. Lakeman and C. B. Crothers.

The Transmission and Distribution Systems of the Rio de Janeiro Tramway, Light & Power Company.

BY L. L. PERRY.

THE 51-mile transmission system of the Rio de Janeiro Tramway, Light & Power Company receives three-phase, 50-cycle current at 88,000 volts from the power plant described in the *Electrical World* of May 13. There are two steel-tower lines, each carrying two circuits of a normal capacity of 9000 hp delivered at Rio de Janeiro. Each circuit has an emergency capacity of 18,000 hp. A private right-of-way, usually 328 ft. (100 m) wide, was acquired. This leaves space for additional tower lines when the present supply of energy becomes inadequate, and allows for ample clearing of the tropical forest, which at many points is heavy. This right-of-way begins at the power house in exceedingly rough country, which extends for 10 miles (15 km); then traverses 25 miles (41 km) of very flat country, and approaches Rio de Janeiro through 16 miles (25 km) of granite mountains, where line construction is difficult and expensive. In such country tower construction is of great advantage, even though the cost of erection is heavy.

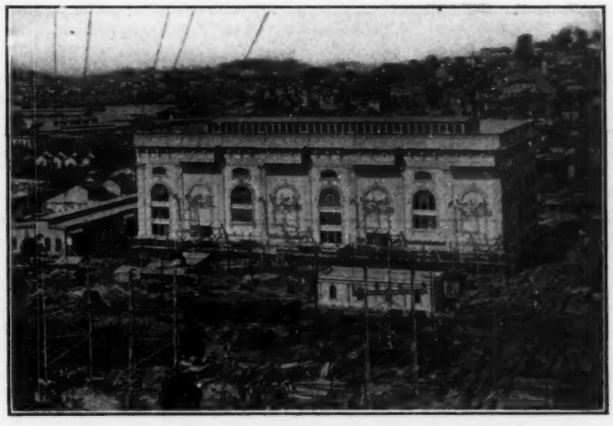


FIG. 1.—TERMINAL STATION IN RIO DE JANEIRO.

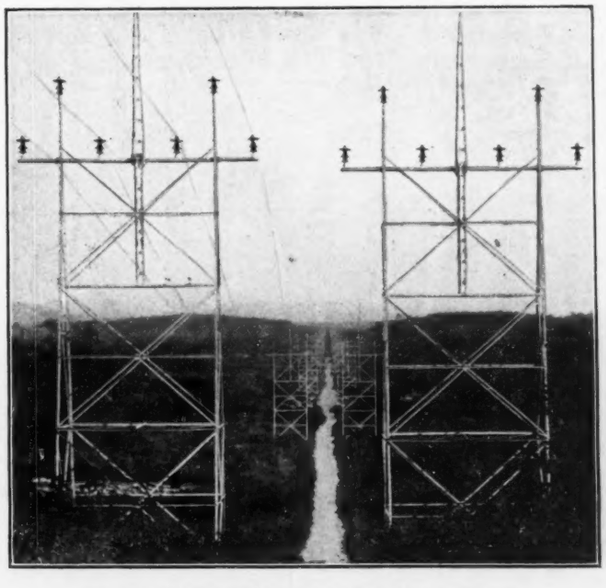


FIG. 2.—TRANSMISSION LINES IN FLAT COUNTRY.

A tower 45 ft. from ground line to lower wire is the standard, with a standard span of 600 ft. (180 m) and a sag of 20 ft. (6.1 m). In view of the long distance from the base of supplies necessitating the placing of orders for tower material long in advance of the final surveys, the following towers were adopted to meet the general conditions:

Style Number.	Height.	Purpose.	Remarks.
1	45 ft.	Standard.	
1a	51 ft.	Standard.	No. 1, with 6-ft. Extension
1b	54 ft.	Standard.	No. 1, with 9-ft. Extension
1c	60 ft.	Standard.	No. 1, with 15-ft. Extension
2	45 ft.	Long span.	
2a	60 ft.	Long span.	No. 2, with 15-ft. Extension
3	45 ft.	Angles 0° to 30°.	
3a	60 ft.	Angles 0° to 30°.	No. 3, with 15-ft. Extension
4	45 ft.	Angles 30° to 60°.	
4a	60 ft.	Angles 30° to 60°.	No. 4, with 15-ft. Extension

Except for the terminal towers practically no towers were designed for special locations.

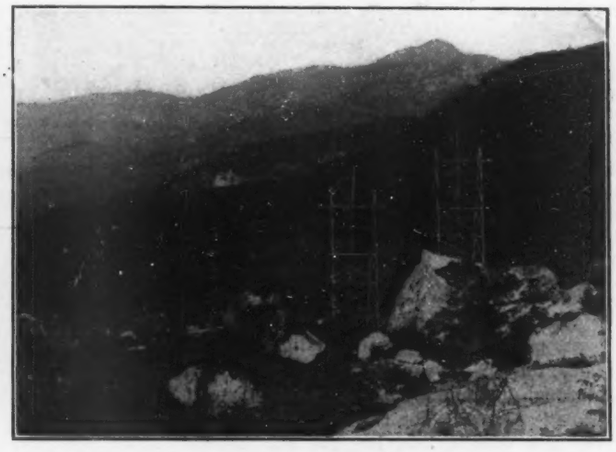


FIG. 3.—TRANSMISSION LINES IN ROUGH COUNTRY.

A triple-part Thomas porcelain insulator, 17½ in. (445 mm) in diameter and 19¾ in. (504 mm) high is used. This was tested in parts, cemented at the factory and shipped in crates containing two insulators each. The conductor is a stranded-copper cable of six wires on a hemp center, with a copper section equivalent to No. 3-0 B. & S. (85 sq. mm). The longest span is 1935 ft. (590 m). A ⅝-in. galvanized Siemens-Martin steel cable is used as a lightning-arrester wire, and, while not a complete protection to the insulators, appears to be of great value.

There are five sets of switch-towers, making six sections of line, and four patrol houses are maintained, with a patrolling force of one foreman and four patrolmen. There are five complete transposition spirals. While no intermediate lightning-arrester stations were originally planned, experience has shown that they are desirable and they have been installed. In addition to the station arresters, horn arresters have been connected at the power-house end of the line. At the two ends of the route, where the line follows along the side hills with higher

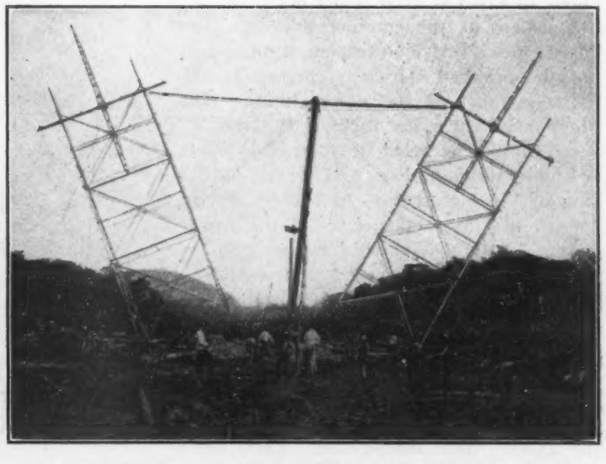


FIG. 4.—METHOD OF RAISING TOWERS FOR TRANSMISSION LINES.

ground projecting above the line, whether rocky or not, there is but slight puncturing of insulators from lightning; but in the flat country, where the line runs for miles just above sea level, the very frequent tropical thunderstorms occasionally give trouble. Often storms of great severity give no trouble.

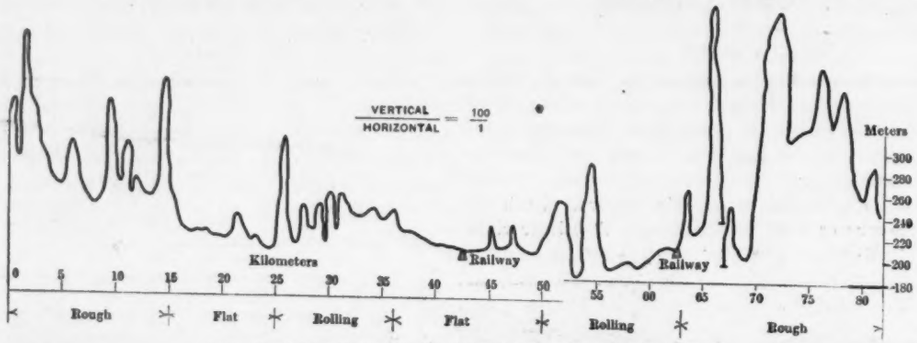


FIG. 5.—PROFILE OF RIO DE JANEIRO TRANSMISSION LINE.

It is to be noted that the climate is particularly adapted to tower construction, for the annual variation in temperature usually does not exceed 40 deg. Fahr. (22 deg. C.), and consequently there is little variation in the sag. There is no sleet and high winds are uncommon.

Two telephone circuits are maintained; one, tapped for the patrol stations, is carried on one tower line; the other is a through line and is carried on light tubular poles. Normally the two lines are as quiet as any 50-mile line, but the one on the tower line is useful in giving prompt notice of any defective insulator on the power circuits. Both lines are of No. 10 B. W. G., BB galvanized iron wire.

TERMINAL STATION.

The transmission system ends at the terminal station, located one mile from the center of Rio de Janeiro. Owing to the high hills surrounding the city it was possible to carry the high-tension lines into the city over a private right-of-way. The terminal station is a steel-frame brick structure on pile foundations. The length over all is 240 ft. (73.2 m), the width is 117 ft. (35.7 m) and the height from basement floor to eaves is 71 ft. (21.7 m). The arrangement of the entering lines, and, indeed, the entire high-tension arrangement of the terminal station, is practically the same as that of the power house. The four lines enter the back of the station; each can be connected to either of two sets of high-tension busbars, and the sectionalizing of the high-tension busbars is carried on in the same manner as in the power house. All the high-tension and low-tension wiring is in masonry compartments.

There are two groups of step-down transformers corresponding to the two groups of step-up transformers in the power house. Each group consists of two banks to step-down from 80,000 volts to 6300 volts, three-phase, and of one bank from 80,000 volts to 23,000 volts, three-phase. Each bank comprises three 1700-kw, single-phase transformers to form a unit of the same size as the generating units of the power house, and the customary oil-insulated, water-cooled transformers are used. The step-down transformers are located in masonry pockets under a crane runway, as in the power house; the low-tension bus structure is located in their rear; above this is the operating floor, and above this the high-tension switches and buses.

This station supplies 6300-volt feeders for general lighting and power work, supplies large energy consumers at 6300 volts, converts current by synchronous motor-generators into 575-volt direct current, and supplies constant-current arc circuits through tub transformers. Current at 23,000 volts can be supplied for suburban service. A gas-engine reserve plant of four 1000-kw alternating-current generators driven by gas engines will be installed in the terminal station. Consequently a flexible bus system was chosen for the 6300-volt cir-

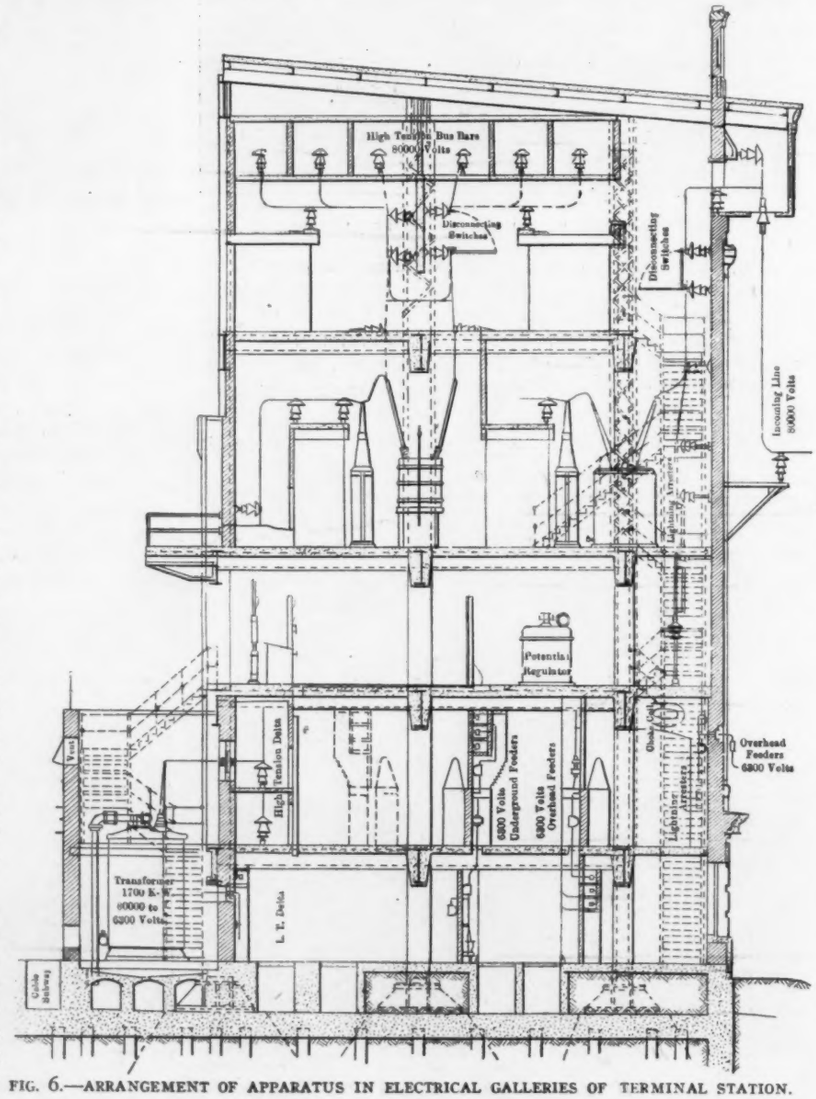


FIG. 6.—ARRANGEMENT OF APPARATUS IN ELECTRICAL GALLERIES OF TERMINAL STATION.

cuits. Duplicate buses are provided throughout, and the important feeders are carried out in two groups, each group from a separate section of the bus.

potential side are connected in pairs through a two-phase-three-phase connection to the three-phase arc buses. A pair of group circuit-breakers on these three-phase arc buses allows the entire

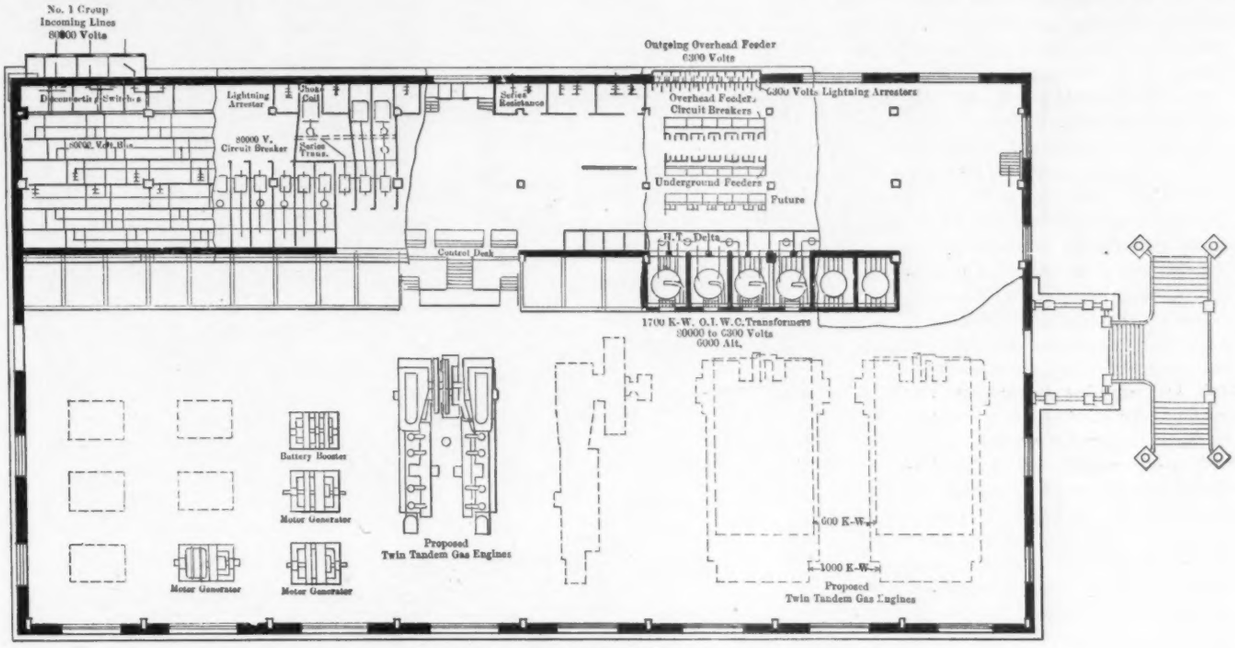


FIG. 7.—PLAN VIEW OF TERMINAL STATION IN RIO DE JANEIRO.

The 6300-volt, three-phase current is converted into 575-volt direct current by five 800-kw synchronous motor-generator sets each consisting of a 1200-hp motor driving an interpolar, compound-wound generator, running at 500 r.p.m. The synchronous motor generators are designed to run at 60 per cent leading power factor in order to bring up the power factor of the entire system. Three of these sets were made by the Westinghouse Electric & Manufacturing Company and two by the General Electric Company. In parallel with the motor generators is a storage battery of the Electric Storage Battery Company's make, with booster and automatic regulation so arranged as to keep the load on the motor generators constant. It has a net discharge capacity of 1000 kw for one hour. It is located in a separate building. The transformers and the entire switchboard

arc system to be transferred from one main set of buses to the other.

Both underground and overhead lighting and power service are supplied at 6300 volts. The underground feeders are divided into two groups of six 500-kw feeders, each group having a pair of circuit-breakers permitting the group to be connected to either set of main buses. Inserted in each group connection is a

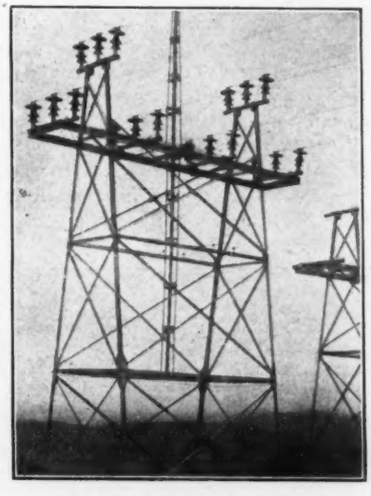


FIG. 8.—TOWER FOR LONG SPANS.

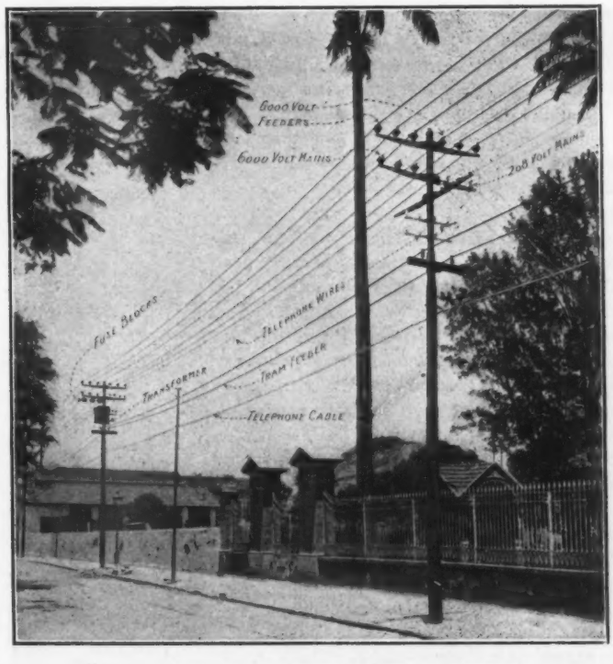


FIG. 9.—OVERHEAD CIRCUITS IN RIO DE JANEIRO.

except for the battery were supplied by the Westinghouse Electric & Manufacturing Company.

The company now supplies 587 7½-amp, series-enclosed, alternating arc lamps for street illumination. These are fed from 100-light, two-circuit tub transformers, and those on the constant-

water-cooled, oil-insulated, three-phase, automatic potential regulator, allowing a variation up or down of 5 per cent. As the voltage of these underground feeders is high relative to their length, only a small drop will occur, and the difference between the drops of these feeders is expected to be small. The

overhead feeders are likewise divided into two groups of six feeders each. The rating of these feeders varies from 1000 kw to 5000 kw, and as their length varies and the drops are relatively high, each overhead feeder has its individual regulator of the automatic type, with a raise or lower of 7½ per cent. The reserve plant will be fed from the lighting mains of the gas department of the company.

Provision is also made for 6300-volt, three-phase feeders to supply power to motor-generator substations now under construction to furnish direct current for distant parts of the trolley system, particularly that of the Jardin Botanico Company, of which control was recently acquired. To supply this last 2000-kw motor-generator sets will be used.

DISTRIBUTION SYSTEM.

The general scheme of distribution comprises a duct system for the 6300-volt, lead-covered, paper-insulated, three-phase primary feeders and mains, and a secondary four-wire, three-phase, armored cable distribution with 120 volts at the lamps and 208 volts across outside wires for motors. The neutral of the secondary circuits is grounded.

Fifteen distributing centers were chosen to which eventually a separate feeder will lead from the terminal station. On account of many narrow streets and other local conditions, it was found best to locate these centers in underground vaults in the streets. The distributing center is also a transformer vault, and from it are carried primary mains to the various subway transformers located in vaults. As there is always a possibility of flooding these vaults at times of tropical rains, all apparatus is waterproof. The illustrations show the arrangement and an interior view of a vault. Three-phase transformers of 40 kw or 80 kw are used, with a 6000-volt primary, and a secondary of 216.5-volt star, 125 volts to neutral. Each transformer is protected by an automatic oil circuit-breaker on the high-tension side and by fuses on the low tension. As all the secondary cables connected to one high-tension feeder are tied into a secondary network, it was considered necessary to provide a ready means of controlling all oil circuit-breakers, those controlling the mains as well as those controlling the transformers; consequently they are made distant control, are actuated through 500-volt solenoids, and can be opened or closed from one central-control point. These circuit-breakers were made by the Westinghouse Electric & Manufacturing Company. All 6300-volt feeders have a section of 97,400 circ. mil (50 sq. mm), and usually the mains are of 48,700 circ. mil (25 sq. mm).

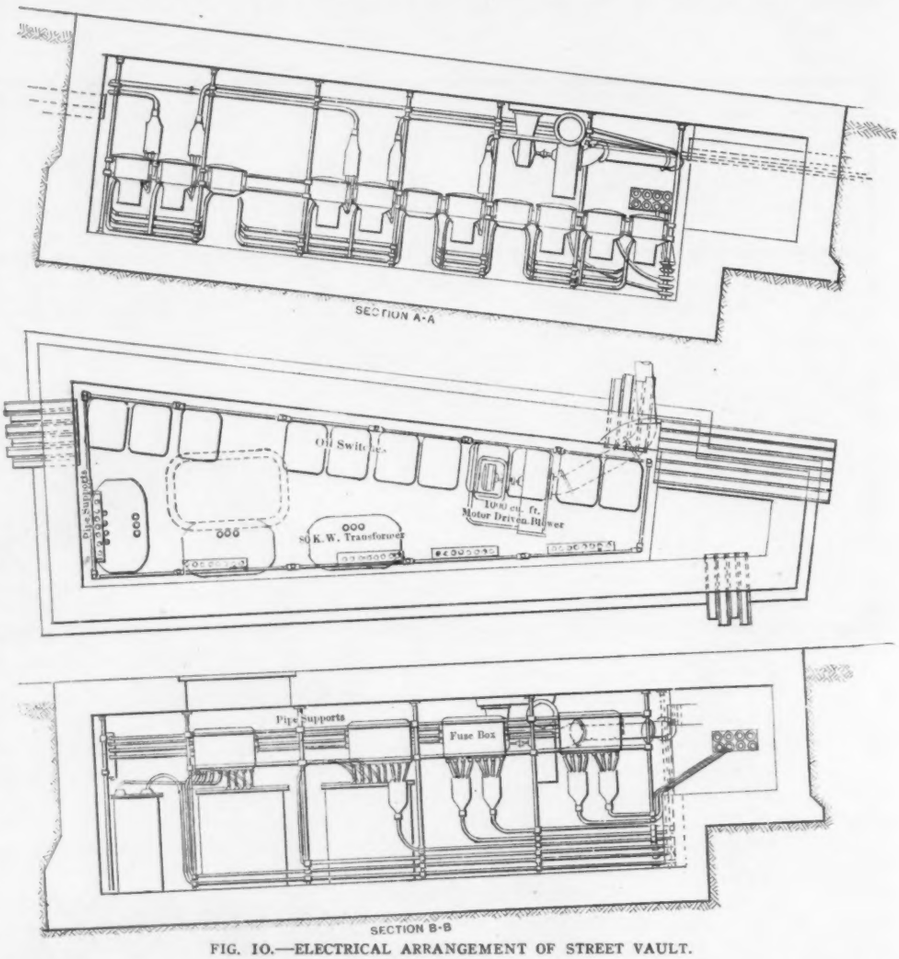


FIG. 10.—ELECTRICAL ARRANGEMENT OF STREET VAULT.

Each transformer is protected on the low-tension side by a water-tight fuse box with cartridge fuses, made by the D & W Fuse Company. Each main is protected by the same type of fuses. The low-tension mains are usually strap-armored cable laid in trenches, but in some important streets, where the load conditions are very uncertain, plain cable in ducts has been

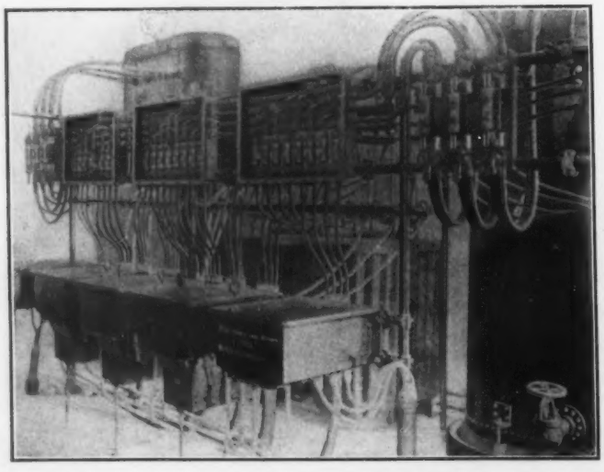


FIG. 11.—APPARATUS IN STREET VAULT.

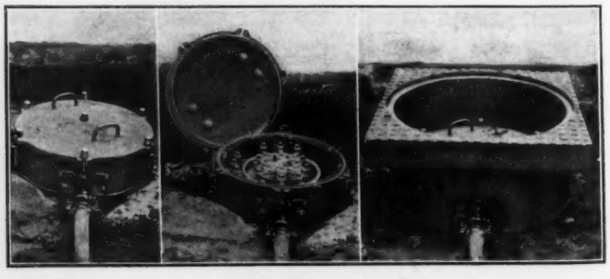


FIG. 12.—LOW-TENSION DISTRIBUTION BOX.

used. The sections vary from 69,000 circ. mil (35 sq. mm) to 296,000 circ. mil (150 sq. mm). At street corners the usual type of distribution box is employed. The section of the neutral conductor is one-half that of the outer wires.

Overhead feeders for motor circuits are of 250,000 circ. mil (128 sq. mm). On account of the rapid deterioration and high cost of wood, steel poles and cross-arms are used, with Thomas porcelain insulators and wrought-steel pins. Since one of the existing electric tramways purchased by the company had in use the harp or bow trolley, this has been adopted as standard, especially as grades are, as a rule, light and but few heavy cars will be used. A special section of trolley has been adopted, as shown in the cut. For the track, standard gage, 4 ft. 8½ in. (144 cm), is used, and either 6-in. T-rail on ties or 7-in. girder on ties is used, with continuous or Weber joints.

FIG. 13.—SECTION OF TROLLEY WIRE.

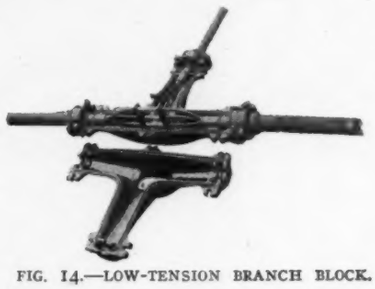


FIG. 14.—LOW-TENSION BRANCH BLOCK.

The transmission, distribution and tramway systems were started under the management of Mr. James Mitchell, and have been built under the management of Mr. F. A. Hountress, with the president of the company, Dr. F. S. Pearson, as consulting engineer.

5000-kw Exhaust-Steam Turbine in Interborough Power House.

The Interborough Rapid Transit Company of New York City has just placed in operation in its subway division power house at Fifty-ninth Street and Eleventh Avenue, a 5000-kw Curtis exhaust-steam turbine on whose performance hinges the immediate installation of two others of the same size and the ultimate doubling of the station output by this means. It is certain from the results already attained by this triple-expansion combination that the highest economy is obtainable and that new life is given to reciprocating engines. It is recognized, and has been for years, that a reciprocating steam engine is only able to take partial advantage of the complete expansion of steam. Multiple expansion engines utilize the steam under good conditions in the high-pressure cylinder, for as these cylinders are relatively small, the friction and radiation losses are low and expansion can be employed up to the carrying capacity of the connecting pipe to the next cylinder. In order to obtain complete expansion in the low-pressure cylinder, however, the dimensions would have to be such as to make the proposition commercially as well as mechanically impossible. A steam turbine, on the other hand, can utilize low-pressure steam to much greater advantage. Thus in the combination of reciprocating engine and low-pressure turbine, each unit is worked at its most efficient range.

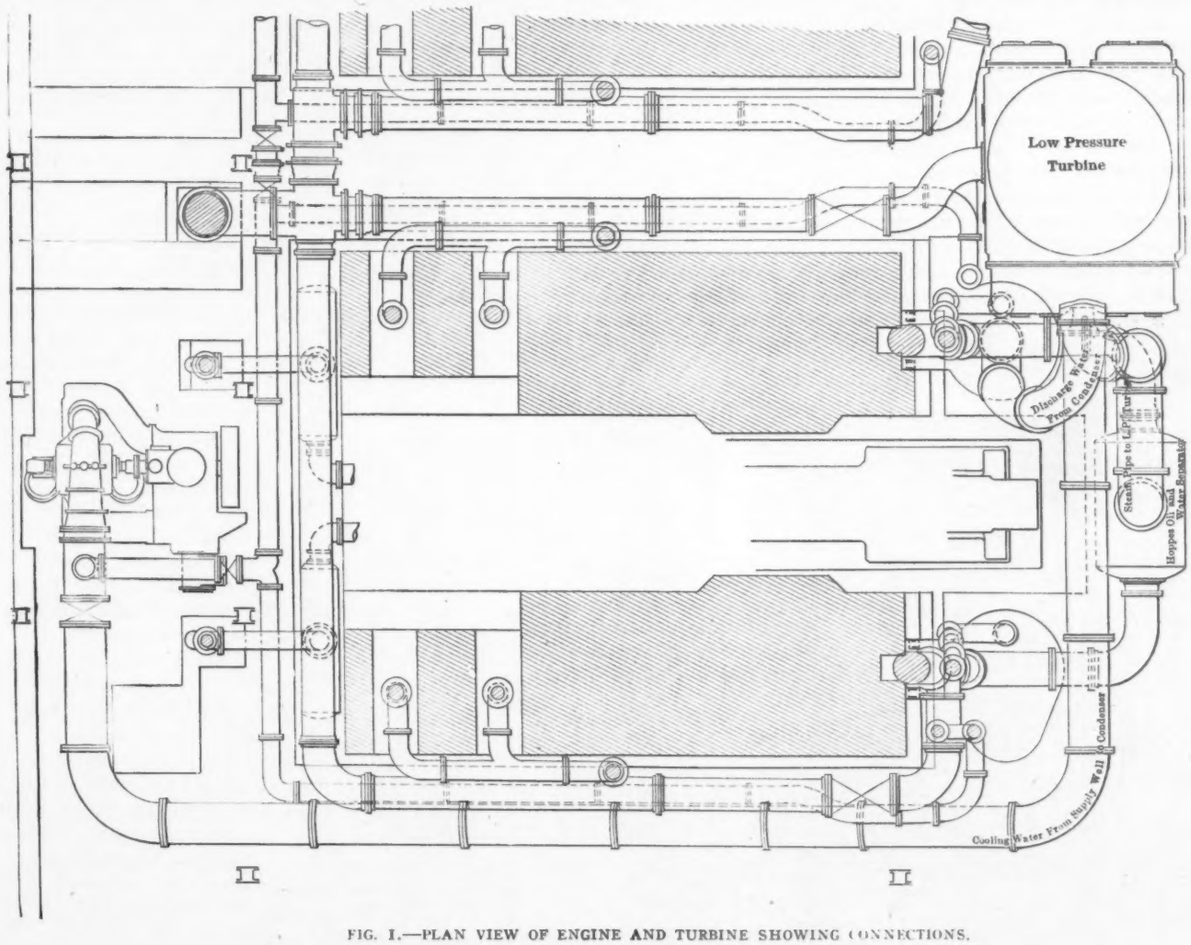


FIG. 1.—PLAN VIEW OF ENGINE AND TURBINE SHOWING CONNECTIONS.

The Interborough power house contains at the present time nine Allis-Chalmers combined double-horizontal and vertical engines having a nominal rating of 7500 ihp, and three Westinghouse-Parsons turbines rated at 1250 kw. The low-pressure turbine is located between the first and second engines and the relative size of both units is well shown in the engravings.

In the engine the high-pressure cylinders are horizontal and the low-pressure cylinders vertical. The dimensions of the cylinders are 42 in. and 86 in. in diameter by 60-in. stroke and the speed is 75 r.p.m. Both pistons of each side of the engine are connected to one crank pin. Steam enters each high-pressure cylinder at from 175-lb. to 200-lb. pressure through a 14-in. pipe and from there passes into a receiver through a 16-in. pipe whence it passes to the low-pressure cylinder. This receiver is not steam jacketed. The engines have poppet valves on all the high-pressure cylinders to provide for the use of superheated steam; but the usual Corliss valve gear is employed on the low-pressure cylinders. The generators are of the Westinghouse, revolving-field, flywheel type, the field structure being mounted directly on the engine shaft. The generators are rated at 5000 kw, 25 cycles, three-phase, 11,000 volts.

Ordinarily the exhaust piping from the engine starts from the condensers with a 30-in. relief valve. From this valve the pipe, which is 30-in. in diameter, drops through the main operating floor to the basement, where the exhausts from the two units unite into one 40-in. riser, which is carried to the roof. The exhaust piping is of riveted steel and is equipped with both corrugated copper and slip expansion joints. The condensing system for each engine-generator unit consists of two Alberger jet condensers with barometric column discharge, two hot wells of concrete and expanded metal, one dry vacuum pump and one cross-compound circulating pump. Each condenser is supported on specially designed steel work placed in front of the engine and is connected directly to the exhaust outlet of the low-pressure cylinder by means of a single elbow on one side and the relief valve of the atmospheric exhaust line on the other. The condenser head or chamber is 50 in. in diameter and terminates at the bottom in a cone-shaped connection to the tail pipe, while the top is provided with a chamber in which the entrained air and vapor collect and to which is connected the air pipe to the dry vacuum pump. On the side 90 deg. from the steam pipe and the exhaust relief valve the circulating water enters, while directly opposite in the vapor chamber is the air-pump connection. The water for use in the condensers is taken from the North River through a concrete tunnel.

The use of the low-pressure turbine has necessitated some changes in the exhaust lines and condensers. The jet condensers are not used on the engine to which the exhaust turbine is connected, the turbine being equipped with a surface condenser instead. The turbine resting directly over the condenser not only makes a better vacuum possible, but by equipping the exhaust pipe between the low-pressure cylinder of the engine and the turbine with an oil separator, the condensation is made available for boiler feed purposes. At present all the boiler feed water is purchased from the city at a large annual expense, and if the condensation from the turbine can be utilized again a saving will result.

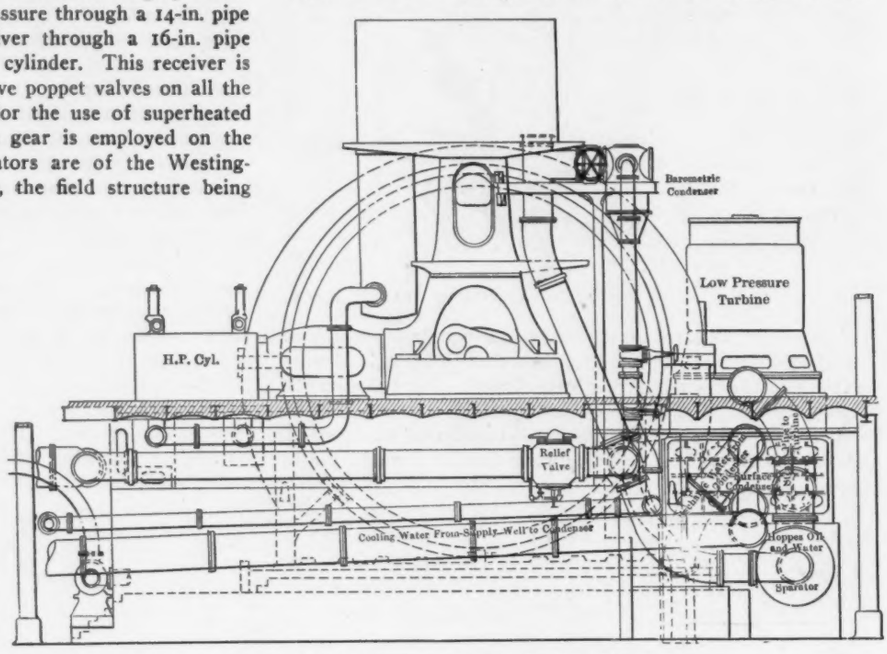


FIG. 2.—SIDE ELEVATION OF ENGINE AND TURBINE.

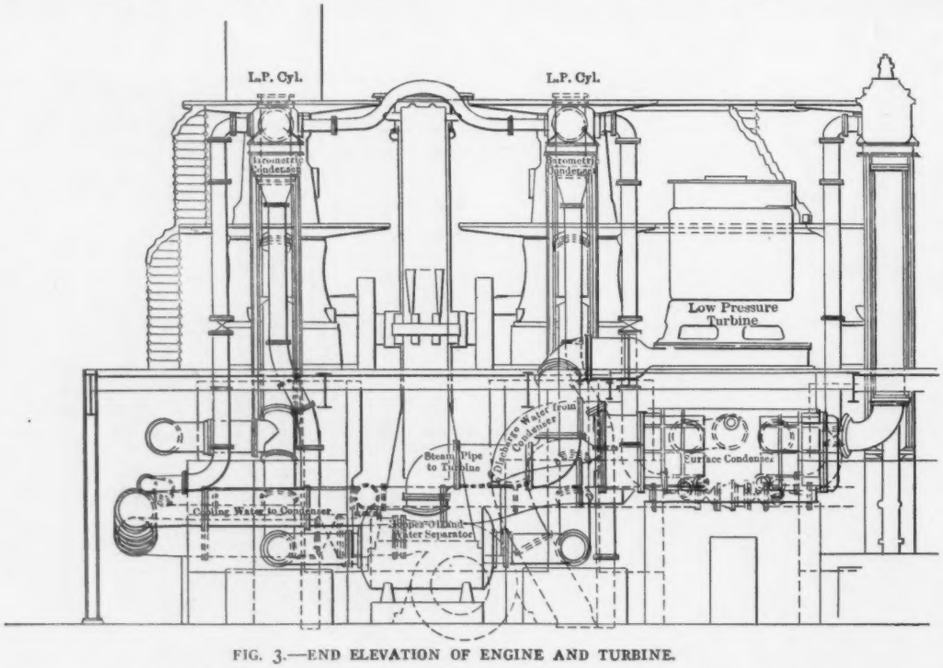


FIG. 3.—END ELEVATION OF ENGINE AND TURBINE.

The low-pressure turbine is directly coupled with an induction generator rated at 5000 kw, three-phase, 25 cycles, 11,000 volts, and the leads are connected to the reciprocating engine generator without switching apparatus. The turbine, which is a three-stage machine, has no governor and is controlled in speed by the engine generators which latter is controlled by the engine governors. On a vacuum of 28 in. and with the low-pressure cylinders exhausting at a back pressure from 12 lb. to 17 lb. absolute, the steam consumption is less than 15 lb. per kw-hour. The combination is still under test, and the results are not at present available for publication, but it may be stated that the output can be doubled by the installation of exhaust steam turbo-generator sets at a cost of about one-third that of the original installation.

The power house occupies the entire square block at Fifty-ninth Street, Eleventh Avenue and the North River, and the structure and site represent the largest item in the investment. Doubling the output does not entail the expenditure of a cent

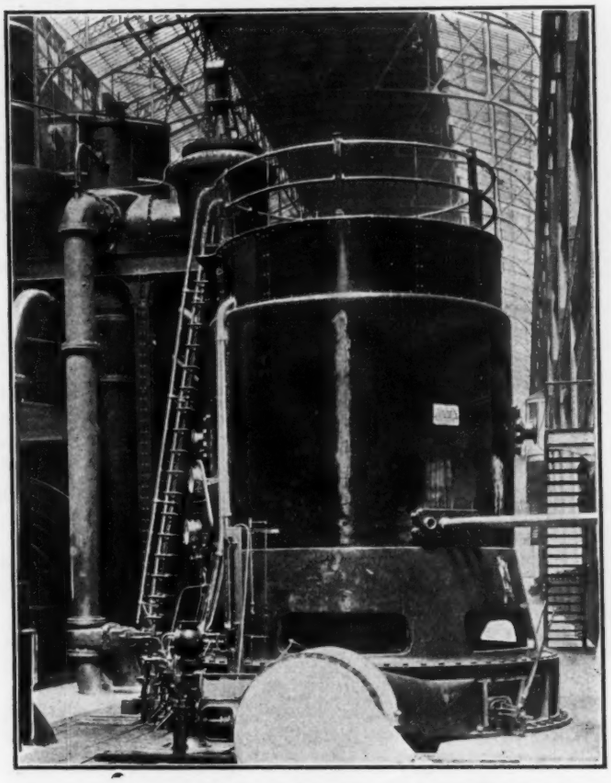


FIG. 4.—5000-KW EXHAUST STEAM TURBINE.

for real estate, it being possible to install the added equipment in the present structure. If reciprocating engines were employed another structure of the same size would be required The illustrations show the connections to the engine and also to the low-pressure turbine so that further comment on the layout is not necessary. H. G. Stott, superintendent of motive power, has given serious thought to this work for some time, and it is to him that the credit of installing the largest low-pressure turbine at present in use is due.

English Generating Station with Large Motor Load.

WHEN the Bolton Electricity Works were started 14 years ago, single-phase current at a pressure of 2200 volts and a frequency of 83 cycles was generated and this supply was transformed in substations in the center of the town to a secondary pressure of 200 volts. This arrangement was naturally not suitable for motor loads, and as an interesting sidelight on the way electricity supply was looked upon in those days, it may be mentioned that the undertaking was under the control of the gas committee. The system was continued until 1900, when a direct-current plant had to be installed for supplying railways. The central area of supply was then provided with electricity for lamps and motors by means of low-tension feeders, the substations mentioned above, one of which is shown in Fig. 1, being used as distribution centers. The single-phase network was and still is used for supplying lamps in outlying districts, but the central area is now all supplied with direct current.

In 1906 a three-phase system was installed, the plant consisting of two 6500-volt, 50-cycle, three-phase, slow-speed condensing sets. With the installation of these machines, a very energetic canvas for motor load was made by the Bolton Corporation, three-phase currents being used for this purpose. By lowering the price of energy furnished for motors during the day, the corporation has been able to connect up over 9000 hp in motors and the load is constantly increasing. Three-phase currents are not entirely used for motor circuits, a certain portion of the energy being converted by means of rotaries which feed into the direct-current network at its most distant points, or where the demand is exceptionally heavy. The future policy of the corporation will be to transform the high-tension, three-phase currents in substations, and then either convert them into direct current or supply them direct to customers as three-phase, low-tension currents.

Fig. 2 illustrates the Duncan Street substation of the Bolton Corporation, which now contains three 600-kw rotaries with the necessary transformers and control boards. The central station at Spa-road is also a substation and in it rotaries and motor-generators of about 900-kw rating are installed as shown in Fig. 3. These machines are used not only for taking the light load on the three-phase network at night, but also as a means for converting a certain amount of energy from one system to the other. This enables the machines of either class to be fully loaded, or in the event of a breakdown of one type of steam generator, to enable a steam generator of another type to act as a standby. The present station at Spa-road lacks adequate water supply for condensing purposes and the limited space for cooling towers and reservoirs made it impossible to adopt turbines when the last extensions were made. The facilities for taking in coal are also defective; all the fuel being carted from a railroad siding some distance away from the station. Under these conditions the generating costs at Bolton may not compare favorably with better situated stations.

The greater part of the three-phase currents, other than those converted, is used direct for cotton spinning work, there being at the present time some 300,000 spindles driven from the corporation's mains. In no case, however, is a complete mill driven electrically. The supply is for one, two or three floors only, and electric drive is generally employed for working the mules, which are the most awkward part of the cotton spinning equipment to drive, as the power is very great for a short time and then drops to nothing for an interval, thus imposing an arduous task on the motor. The transformers and necessary switch-

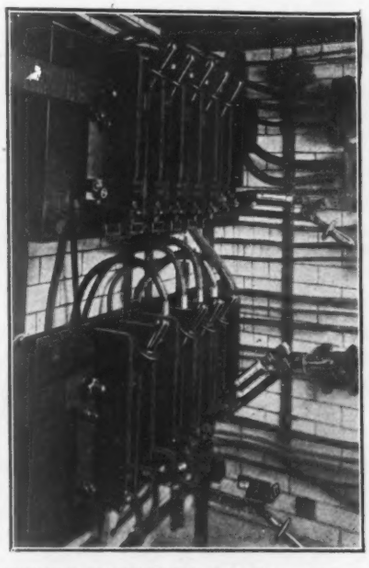


FIG. 1.—LOW-TENSION DISTRIBUTION BOARD IN THE BALMORAL SUBSTATION.

board for supplying mules, up to the present are installed in a special substation on the mill premises. The station is, however, kept under the entire charge of the corporation's electricity department. The voltage is in all cases stepped down from 6500 to 400 for use on the mill motors. In some cases the lamps in the mills are supplied with electricity by means of a fourth wire at 230 volts.

The experience obtained in Bolton with this type of motor

drive shows that the results are satisfactory in every way, the only point about which trouble occurs is the price of energy. The usual course adopted by the Bolton corporation in installing electric drive in mills has been to fix a three-phase motor with slip rings direct to the line shafting driving the mule-operating room. The speed of the shafting has generally been increased over that which was used with the steam-driven machines. The

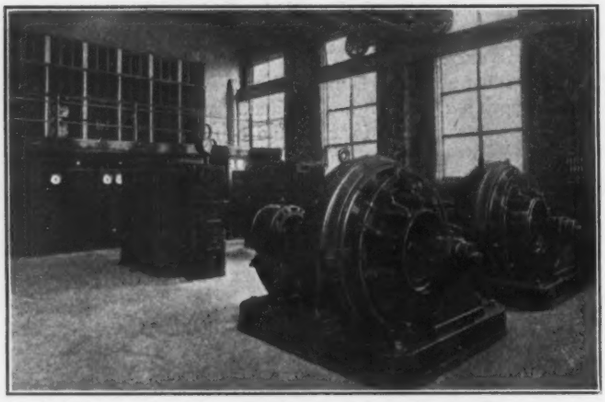


FIG. 2.—EQUIPMENT IN DUNCAN STREET SUBSTATION.

speed of the machine has also been somewhat increased. Although cotton spinning is the industry on which Bolton most relies, there are several engineering works which have installed motors aggregating 1200 hp for driving cranes, tools, conveyors, etc. Three customers on the direct-current mains take over 7,000,000 kw-hours yearly and have installations aggregating 3000 hp. Two of the concerns have a load factor of over 30 per cent.

The recently issued accounts for the year show the total output from the Bolton station to be 10,677,764 kw-hours, of which no less than 46 per cent was for motor circuits entirely and 15 per cent for lighting circuits only. It is essential, of course, that the energy supplied for motors should be at a low rate, for the load which is obtained is of such a steady character and in such large units that consumers would use their own plants

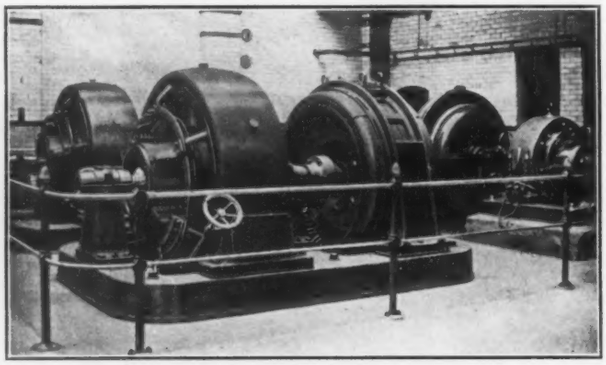


FIG. 3.—MOTOR-GENERATOR SETS IN SPA ROAD GENERATING STATION.

unless the price were reasonable. It appears from the accounts that the average price obtained per kw-hour from all classes of supply is 1.23d (2.46 cents), and for motor circuits, 0.84d (1.68 cents). Although this price may be considered fairly low for a municipal station of the size of that at Bolton, a gross profit of 9 per cent on the capital has been obtained. The works costs with the handicaps previously mentioned are given as 0.472d (0.944 cent) per kw-hour and the total costs, 0.583d (1.166 cents). The inclusive cost, including capital charges, is 1.2d (2.4 cents). In March, 1901, the number of motors on the mains was 27, with an aggregate rating of 148 hp; on the same date in 1909 the number of motors was 816 and their aggregate rating 9219 hp.

A Contribution to the Statistics of International Electrical Engineering Symbology.

By A. E. Kennelly.

In view of the discussion which has of late years been carried on concerning the possibility of adopting an international set of symbols for the principal formulas of electrical engineers, the writer here presents the results of an examination into the notation of recent text-books from countries which have a large and independent electrical engineering literature.

In making the examination, care was taken to avoid forming any theory in advance, or preconceived notions, as to what the results of such an inquiry might be. No comparisons were attempted until the individual records had been completed. Indeed, now that the comparative notations of different countries are presented, no particular line of argument or deduction is invoked. The object is merely to indicate the agreements and differences among the notations in use between different countries.

It was decided to confine the examination to recent literature. Accordingly, with but one exception, the books or documents accepted have all been published since the year 1900. Consequently, these statistics bear upon current notation; or, at least, upon notation that has until very recently been current.

It was also decided to limit the inquiry to electrical-engineering literature. It will be evident that if electro-chemistry, physical chemistry, physics, chemistry and astronomy were included, with their numerous applications to industry, the list of necessary symbols would be very long.

In order to present the results of the inquiry in tabular form, capable of being covered by one view, and yet revealing the individual accordances or discordances, it was decided to limit the number of entries to seven from each country.

Table No. I sets forth five groups of publications, from France, Germany, Great Britain, Italy and the United States, respectively. Seven publications appear for each country. Where possible, the seventh publication in each group is taken from an official or semi-official source. For France, we have the Hospitalier notation; for Germany, a notation suggested by a special committee of the Elektrotechnischer Verein; for Great Britain, a recent volume of the *Journal* of the Institution of Electrical Engineers; for Italy, a paper from the *Journal* of the Associazione Elettrotecnica Italiana; and for the United States, the notation proposed in the Standarization Rules of the American Institute of Electrical Engineers.

The remaining publications have been taken, more or less at random, from a list of representative national text-books, and without any prior reference to the particular notations they contain. It is believed that, although seven examples may not be a satisfactorily large number through which to deduce a national average, yet, taken collectively, they fairly exhibit the current state of electrotechnical notation in the countries represented. If more extensive inquiry should indicate that the actual average usage is not well shown, the discrepancy is to be attributed to the chances of selection, and is entirely accidental.

In Table II the various symbols used in the above-mentioned 35 publications are set down in parallel columns, each under its appropriate number as given in Table I. In many cases, two or more symbols have been used in the same publication for one physical quantity; as L and l for self-inductance, or E and e for e.m.f. In such cases, the variants are included, as far as possible. In many instances the variants run over and occupy an extra line below.

It will be seen that there are 21 electric, magnetic or electromagnetic quantities in the list, and 15 subsidiary fundamental quantities, making a total of 36 entries in all. This is not a long list comparatively. The list of symbols recommended by the Notation Committee of the Chicago Congress (1893), with the additions of the Paris Congress (1900), contains 43 quantities. The list recommended by the Notation Committee of the Elektrotechnischer Verein in 1902 contains 53 quantities (Vorschlagliste, June 5, 1902), and that recommended similarly in 1906 contains 39 quantities. Although "admittance," "sus-

ceptance" and a few other quantities in technical use do not appear in Table II, yet it is believed that the most important electrical engineering quantities will appear therein.

It will be observed that, so far as Table II shows, there is already substantially complete international agreement on the symbols for the following six electric, magnetic or electromagnetic quantities:

for (1) length, (2) volume, (3) time, (4) angle, phase-displacement, (5) velocity, and (6) efficiency. Moreover, in the cases of potential, reactance, impedance and permeability, the agreement is nearly complete. Even among the quantities where there is the most international disagreement, the differences in usage between different publications in the same country are sometimes of the same order of magnitude and frequency as the differences in the usage therein between the different countries.

TABLE I

TABLE OF PUBLICATIONS CONSULTED

Country	No	Title of Publication	Pub. Date	Author	Pages	Publisher
France	1	Essais des Machines a Courant Continu et Alternatif	1907	P. Bourguignon	299	Ch. Béranger. Paris.
	2	Distribution de l'énergie par Courants Polyphasés.	1903	J. Rodet. (2d Edition)	561	Gauthier-Villars. Paris.
	3	Contrôle des Installations Electriques	1904	A. Monmerqué. (2d Edition)	775	Ch. Béranger. Paris.
	4	La Technique de la Houille Blanche	1908	E. Pacoret	830	H. Dunod & E. Pinat. Paris.
	5	Phénomènes Fondamentaux et Principales Applications du Courant Alternatif.	1904	R. Swyngedauw	173	Ch. Dunod. Paris.
	6	Pratique des Essais des Machines Electriques a courant continu et alternatif.	1903	E. Duquesne and U. Rouvière	362	Ch. Béranger. Paris.
	7	[Hospitalier Notation]	....	E. Hospitalier	...	
Germany	1	Die wissenschaftlichen Grundlagen der Elektrotechnik. 2d Edition.	1907	Gustav Benischke	580	Julius Springer. Berlin.
	2	Elektrische und Magnetische Messungen und Messinstrumente.	1906	H. S. Hallo and H. W. Land	517	Julius Springer. Berlin.
	3	Handbuch der Elektrischen Beleuchtung. 3d Edition.	1907	Joseph Herzog and Clarence Feldmann.	765	Julius Springer. Berlin.
	4	Prinzip und Wirkungsweise der Technischen Messinstrumente für Gleichstrom.	1908	Fritz Hoppe	64	J. A. Barth. Leipzig.
	5	Elektrotechnische Messkunde. (II Band Grundriss der Elektrotechnik).	1908	Alex. Königswerther	167	Max Janecke. Hannover.
	6	Messungen an Elektrischen Maschinen. 2d Edition.	1907	Rudolf Krause	193	Julius Springer. Berlin.
	7	Elektrotechnischer Verein. Vorschlagsliste A	1906		...	*Elek. Zeitschrift*, April 19, page 396.
Great Britain	1	Handbook for the Electrical Laboratory and Testing Room.	1901	J. A. Fleming	1 538 11 622	*The Electrician* Series. London.
	2	Electric and Magnetic Circuits	1903	Ellis H. Crapper	379	Edwin Arnold. London.
	3	Submarine Cable Laying and Repairing. Revised Edition.	1908	H. D. Wilkinson	557	*The Electrician* Series. London.
	4	Dynamo-Electric Machinery. Revised Edition " " " " " "	1904 1905	Silvanus P. Thompson " " "	1 984 11 848	E. & F. N. Spon. London. E. & F. N. Spon. London.
	5	Electricity Meters	1906	Henry G. Solomon	323	C. Griffin & Co. London.
	6	Vectors and Vector-Diagrams	1909	William Cramp and C. F. Smith	252	Longmans, Green & Co. London.
	7	*Journal* of Institution of Electrical Engineers. Vol. 41.	1908	Various	872	The Inst. El. Engrs. London.
Italy	1	La Tecnica delle Correnti Alternate " " " " "	1903	Giuseppe Sartori " "	1 336 11 495	Ulrico Hoepli. Milan. Ulrico Hoepli. Milan.
	2	Le Frodi nei Misuratori Elettrici	1908	M. Lanfranco	277	Ulrico Hoepli. Milan.
	3	Impianti Elettrici a Correnti Alternate	1907	Attilio Marro	338	Ulrico Hoepli. Milan.
	4	Cavi Telegrafici Sottomarini	1896	E. Jona	338	Ulrico Hoepli. Milan.
	5	Trattato di Telefonia. Parte I	1905	I. Brunelli and E. Longo	96	G. Scotti & Co. Rome.
	6	I Metodi Elementari per la Rappresentazione e lo Studio delle Correnti Alternate Sinusoidale	1903	G. Giorgi	15	L' Elettricista 1903. Rome.
	7	Magnetizzazione del Ferro per Effetto di due Campi Ortogonali.	1909	Giancarlo Vallauri	35	*Atti* dell' Assoc. Elet. Italiana, March, 1909.
United States	1	Testing of Electro-Magnetic Machinery and Other Apparatus. Vol. I.	1904	Bernard Victor Swenson and Budd Frankenfield.	420	The Macmillan Co. New York.
	2	An Introduction to the Study of Electrical Engineering. 1st Edition.	1907	H. H. Norris	404	John Wiley & Sons. New York.
	3	Theoretical Elements of Electrical Engineering	1902	Charles Proteus Steinmetz	330	*Elec. World and Engineer*, New York.
	4	Alternating-Current Machines. 7th Edition	1908	Samuel Sheldon, Robert Mason and Erich Hausmann.	353	D. Van Nostrand Co. New York.
	5	Dynamo-Electric Machinery	1908	Francis B. Crocker	235	American School of Correspondence. Chicago.
	6	Electrical and Magnetic Calculations	1903	A. A. Atkinson	310	
	7	Standardization Rules of the American Institute of Electrical Engineers.—Recommended Notation.	1907		...	Am. Inst. El. Engrs. June 1907.

Electromotive Force—*E e*.
Electric Quantity—*Q q*.
Magnetic Intensity—some type of capital *H*.
Magnetic Flux Density—some type of capital *B*.
Self-Inductance—*L l*.
Mutual Inductance—some type of capital *M*.

Among subsidiary quantities there is also substantially complete international symbolic agreement indicated in the table

While, therefore, it is clear that international agreement on the entire list could not be attained without mutual adjustment, change and compromise between the national notations, it seems that if the actual state of affairs is correctly presented by the table, about one-third of all the quantities given in the list are ready at once for international standardization, without

TABLE II.—COMPARATIVE TABLE OF SYMBOLS APPEARING IN ELECTRICAL ENGINEERING TEXT BOOKS PUBLISHED IN DIFFERENT COUNTRIES SINCE A. D. 1900.

	Quantity	Unit	France							Germany							Great Britain							Italy							United States						
			1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
General	Energy or Work	Joule	T	.....	W	W	T,U,W,w	P,T,W	W	A,a	A,W	T	.....	.....	.....	A	E	W,w	.....	.....	.....	.....	.....	w	W	L	.....	L	.....	w	W	W	W	W	.....	.....	.....
	Power or Activity	Watt	P,W,w	P	P	$P,\mathfrak{p}$	P	$P,\mathfrak{p},W$	P	$P,\mathfrak{p}$	W	W	.....	$\mathfrak{L}$	A,N W	.....	P	P	.....	P,W,w	P,W	.....	.....	P,Q,γ,W	.....	P,W	.....	.....	.....	.....	P	P	.....	.....	W,w	P,W	P
Electric	Electromotive Force	Volt	E,e,ε,η	$\mathfrak{E},e,\varepsilon$	E	E,e	E,e	$\mathfrak{E},E,e$	E,e	E,e	E,e	E,e	E	E,e	E,e	E	E,e	E,e	E,e	$\mathfrak{E},E,e$	E	E	...	E,e	e	e	.....	e	E	.....	E,e	E,e	E	E,e	E,e	E	E,e
	Potential or P. D	Volt	U,V	U,u,V	U,u,V	.....	V,v	.....	U,u	K,k,U	V	V,v	.....	V,k	.....	.....	U,V,v	V,v	$P,\mathfrak{p}$	V	V,v	V	V,v P	V,v	V	V,v,u	V,v	.....	V	.....	.....	.....	.....	.....	V	.....	.....
	Current Strength	Ampere	I,i	$\mathfrak{J},J,j,i$	I,i	I	I,i,j	I,i	I,i	$\mathfrak{J},J,i$	J,i	I,J,i	I,J,i	i	$\mathfrak{J}$	I	A,C,I,i	C,c	C	C	A,C,c	C	A,C,c	I,J,i	I,i,j	i	i	I,i	I,i	i	I,i	I,i	I,i	I,i	I	I	I,i
	Quantity	Coulomb	Q	.....	Q	.....	$Q\,q$	.....	Q,q	Q,q	Q,q	q	.....	Q	.....	Q	Q,q	Q	Q,q	.....	.....	.....	.....	Q,q	.....	.....	Q,q	.....	.....	.....	Q,q	Q	Q	Q	.....	Q	.....
	Capacity	Farad	C	C	.....	C,c	C	.....	C,c	C	C	C,c	C	C	.....	C	C	K	F,f,K,k	K	.....	K	K,k	C	.....	C	C,Φ,ϕ	C	K	.....	C,c	C,c	C	C	.....	C	C,c
	Resistance	Ohm	R,r,ρ	R,r	R,r	R,r	R,r	R,r	R,r	W,w,ρ	R,r,W,w	R,r,w	W	W,w	R,r,g,w'	.....	R,r	R,r	R,r	R,r	R,r	R,r	R,r	R,r	R,r,ρ	R,r	R	R	R	.....	R,r	R,r	R,r	R	R,r	R,r	R,r
	Reactance	Ohm	.....	.....	.....	.....	.....	.....	X	.....	x	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	x	.....	x	Λ,λ	.....	.....	.....	.....	.....	X,x	x	X,x	X	.....	.....	x
	Impedance	Ohm	.....	Z	.....	.....	.....	.....	Z	.....	z	$\mathfrak{R}$	.....	.....	.....	.....	.....	.....	.....	.....	.....	Z	.....	Z	z	Z	.....	.....	.....	.....	Z	z	Z,z	Z	.....	.....	Z,z
	Resistivity	Ohm.cm	ρ	ρ	ρ	.....	ρ	.....	ρ	α	.....	.....	.....	.....	c	.....	.....	σ	.....	ρ	.....	.....	.....	ρ	.....	.....	.....	ρ	.....	.....	σ	.....	ρ	.....	ρ	K	.....
	Conductivity	Mho/cm	.....	.....	γ	.....	c	.....	γ	.....	.....	.....	.....	.....	λ	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	c	.....	.....	.....	γ	.....	.....	.....	.....	.....
Magnetic	Magnetomotive Force	Gilbert*	.....	$\mathfrak{F}$	$\mathfrak{F}$	$\mathfrak{F}$	F	.....	$\mathfrak{F}$	$\mathfrak{F},f$	.....	.....	.....	.....	.....	.....	.....	.....	.....	X	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	$\mathfrak{F}$	.....	$\mathfrak{F}$	.....	.....	M	.....
	Magnetic Intensity	Gilbert/cm	$\mathcal{H}$	.....	$\mathcal{H}$	$\mathcal{H}$	H	$\mathcal{H},H$	$\mathcal{H}$	h	H	.....	H	H	H	h	.....	$\mathbf{H}$	.....	$\mathbf{H},\mathcal{H}$	H,h	.....	$\mathbf{H}$	H	.....	.....	.....	.....	.....	.....	H	$\mathcal{H}$	H	$\mathcal{H}$	$\mathcal{H}$	H	H	.....
	Magnetic Flux	Maxwell	Φ	$\Phi,\mathfrak{f}$	Φ	Φ	Φ	Φ	Φ	.....	Φ	.....	Z	Z	Φ	.....	.....	$\mathbf{N}$	.....	$\mathbf{N}$	F	F	N	Φ	.....	$\mathfrak{N}$	.....	.....	.....	.....	Φ	Φ	Φ,ϕ	Φ	Φ	ϕ	ϕ	Φ
	Flux Density	Gauss	$\mathfrak{B}$	$\mathfrak{B},\beta$	$\mathfrak{B}$	$\mathfrak{B}$	F,B	$\mathfrak{B},B$	$\mathfrak{B}$	$\mathfrak{B}$	B	.....	.....	B	B	$\mathfrak{B}$	.....	$\mathbf{B}$	.....	$\mathbf{B},\mathfrak{B}$	B	.....	$\mathbf{B}$	$\mathfrak{B},B$	.....	$\mathfrak{B}$	.....	.....	.....	.....	$\mathfrak{B}$	B	$\mathfrak{B}$	$\mathfrak{B}$	B	B	$\mathfrak{B},B$
	Reluctance	Oersted*	.....	.....	$\mathfrak{R}$	.....	.....	.....	$\mathfrak{R}$	w	.....	.....	.....	.....	.....	.....	.....	$\mathfrak{R}$	.....	.....	.....	.....	.....	$\mathfrak{R}$	.....	.....	.....	.....	.....	.....	$\mathfrak{R}$	$\mathfrak{R}$	ρ	$\mathfrak{R}$	R	$\mathfrak{R}$	.....
	Reluctivity	Oersted.cm	.....	.....	ν	.....	.....	.....	ν	.....	.....	.....	.....	.....	.....	.....	.....	$\mathcal{K}$	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	ρ	.....	.....	ρ	.....	k	.....
	Permeability	1/(oersted.cm.)	.....	μ	μ	.....	$\mathfrak{p}$	.....	μ	μ	μ	μ	μ	μ	.....	μ	μ	μ	.....	μ	.....	μ	μ	μ	.....	μ	.....	μ	μ	.....	.....	μ	μ	μ	μ	μ	μ	.....
Electro-magnetic	Inductance Self	Henry	L,S	L	L	L,l	.....	L	L,l	L,λ	L	L	.....	L	L	L	L	.....	.....	L	.....	L,l	L	L	L	$\mathfrak{L}$	.....	.....	L	.....	L	L	L,S	L,l	L	L	L,l
	Inductance Mutual	Henry	.....	.....	.....	.....	.....	.....	.....	M	.....	.....	.....	.....	.....	.....	M	.....	.....	M	.....	M	.....	M	.....	$\mathfrak{M}$	.....	.....	M	M	.....	.....	M	.....	.....	.....	.....
Fundamental and Subsidiary	Length	Cm., ft., etc	l	l	L,l	l	l	.....	L,l	l	l	L,l	l	L,l	l	l	.....	l	.....	l,λ	.....	.....	l	L,l	l	l	l	l	.....	L	l	l	l	l	l	l	.....
	Surface Area	Cm^2. sq. ft., etc	S	S,σ	S,s	.....	s	S	S,s	S	F	.....	F	.....	.....	.....	.....	.....	.....	A	.....	.....	.....	s	σ	Q,A	S	.....	.....	S	A,s	A	.....	A,S	A,s	A,a,s	.....
	Volume	C.c., c. ft., etc	.....	.....	V	V	V	V	V	v	V,v	.....	.....	.....	v	V	.....	.....	.....	.....	.....	.....	.....	.....	V,v	.....	.....	.....	.....	.....	.....	.....	V	V	v	.....	V	...,
	Mass	G., kg., lb., etc	.....	.....	M,P	.....	.....	.....	M	.....	m	.....	M	m	m	m	.....	W	.....	.....	M	.....	M	$\mathfrak{p}$	.....	G,P	P	.....	.....	.....	M	.....	.....	W	.....	m,W	.....
	Time	Sec., min	T	t	T,t	T	T,t	.....	T,t	t	t	T	T	t	t	t	T,t	t	.....	T	T,t	.....	T,t	T,t,τ	T,t	T	T,t	t	.....	.....	t	t	.....	t,τ	t	T,t	.....
	Angle	Radian, Deg	α	α,β	α,β	α,θ	.....	α	α,β	.....	α	α,θ	α	α	α	α,β	.....	θ,A	.....	θ	ϕ,Φ	α,θ	θ	α,β,∂	γ,∂	α	α	.....	.....	α,β	α,β,θ	θ,θ,ω	α,ω	α	λ,ψ	.....	.....
	Angle	Phase Diff	ϕ	ϕ,ψ	ϕ	ϕ	.....	ϕ	.....	.....	ϕ	ϕ,ψ	.....	ϕ,ψ	ψ	ϕ	.....	.....	.....	ϕ	.....	ϕ	ϕ	ϕ,ψ	ϕ,ψ	ϕ	ϕ	.....	ϕ	.....	.....	.....	ϕ,ψ	ϕ	.....	ϕ	.....
	Temperature	Deg. Ab. or C	t,θ	.....	θ	.....	.....	.....	.....	.....	t	.....	t	T,t	T,t	$T,\dagger A$ $t,\dagger C$	.....	.....	.....	.....	$n°$	.....	t	T	t,τ	t	t	.....	.....	.....	t	.....	.....	t	t	t	.....
	Velocity	Cm./sec	v	.....	v	V	v	V	v	.....	v	.....	.....	v	v	v	.....	v	.....	v	.....	.....	v	.....	.....	.....	v,t,u	.....	.....	.....	V,v	v	.....	.....	.....	v	.....
	Angular Velocity	Radian/sec	ω	.....	ω	ω	ω	ω	ω	ω	ω	ω	.....	ω	ω	ω	$\mathfrak{p}$	.....	.....	$\Omega,\omega,\mathfrak{p}$	$\mathfrak{p},\omega$	.....	$P,\mathfrak{p},\omega$	ω	$\mathfrak{p}$	.....	.....	.....	ω	.....	.....	.....	.....	ω	ω	.....	.....
	Angular Velocity	Rev/sec., Rev/m	N	N	N	n	.....	n	.....	.....	.....	.....	.....	.....	.....	n	.....	.....	.....	n,U	n	n	.....	.....	.....	.....	u,n	.....	.....	.....	V	.....	.....	V	n	v	.....
	Frequency	1/second	f	n	.....	$\sim$	.....	f	n	ν	c	$z,\sim$	.....	ν	ν	.....	n	.....	.....	f	n	$\sim$	.....	f	n	f	.....	.....	.....	.....	f	f	N	f	.....	f	.....
	Force	Dyne., lb.-wt	$P,\mathfrak{p},T$	.....	F,f	F	.....	F	F,f	F,f	K	.....	P	f,K	K,P	.....	.....	F,f	.....	F	.....	.....	.....	F	F	k,T	P,T	.....	.....	.....	$F,f,\mathfrak{p}$	F	.....	T	F	F,W,w	.....
	Acceleration	Velocity/sec	.....	.....	a,g	.....	.....	.....	a	.....	$g,\jmath$	.....	.....	.....	.....	g	.....	a,g	.....	g	g	.....	.....	.....	.....	g	.....	.....	.....	.....	.....	.....	.....	.....	.....	g	.....
	Torque	Force. perp. cm	C	$\mathfrak{M}$	C	C_m	C	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	T,t	D,T	.....	.....	.....	.....	.....	.....	.....	.....	.....	T	.....	.....	.....	.....	.....	.....
	Efficiency	Output/input	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	η	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	η	.....	.....	.....	.....	η	.....	.....	η	.....	.....	.....

*The names "gilbert" and "oersted" have never received international recognition. They were only provisionally adopted by the American Institute of Electrical Engineers. †Only T for Deg. Abs. and t for Deg. Cent.

any change or compromise; while the task of bringing about international agreement among the remaining two-thirds is, perhaps, not much greater than the task would be of bringing about systematic and uniform notation within the limits of several individual countries, without reference to international usage. In other words, since some effort is evidently necessary in order to effect national standardization of symbols, perhaps not much additional effect would be required to effect international standardization.

HISTORICAL OUTLINE OF THE MOVEMENT TOWARD INTERNATIONAL STANDARDIZATION OF ELECTRICAL ENGINEERING SYMBOLS SINCE THE INTERNATIONAL ELECTRICAL CONGRESS IN CHICAGO IN 1893.

The International Electrical Congress of Chicago appointed a committee from the chamber of Government delegates to conside the subjects of nomenclature and notation, with M. Edouard Hospitalier as its chairman. The committee reported in favor of a list of 38 symbols. The chamber voted to print the report as an appendix to the general report of the chamber.[1] The system of notation presented in that list has been called the Hospitalier system of 1893.

Prior to the date of the Chicago congress, the notation current in American electrical engineering literature did not differ noticeably from that simultaneously current in the electrical engineering literature of Great Britain. After the publication of the Hospitalier system, however, in the Chicago congress proceedings, electrical engineering literature in the United States indicated a tendency to diverge from the British notation, and to follow the Hospitalier notation in those symbols wherein these two notations differed. In a considerable measure this influence, regarded as an international approximation, was exerted by the electrochemical press in the United States.

In Germany, electrotechnical notation received much attention from the Elektrotechnischer Verein, whose committee on notation reported in 1902 and 1904, and in 1906. (See bibliography appended.)

Attempts were made in the United States in 1903-04 to have the subject of an international technical notation brought before an international congress at the St. Louis World's Fair in 1904. Joint committees on notation were appointed by the American Physical, Chemical and Electrochemical societies, as well as the American Institute of Electrical Engineers and the Bureau of Standards. A proposed list of 95 symbols was jointly drawn up and was brought before a branch of the International Congress of Arts and Sciences at St. Louis, but no action was taken.

The subject of international electrotechnical symbols was discussed in subcommittee by the council of the International Electrotechnical Commission in London, October, 1908.

BIBLIOGRAPHY.

Proceedings of the International Electrical Congress of Chicago, 1893.

Symbols for Physical Quantities and Abbreviations for Units, *Electrical World*, N. Y., Vol. 24, Aug. 25, 1894, p. 179, and Vol. 37, Jan. 5, 1901, p. 3 and p. 50.

L'Industrie Electrique, July 25, 1902, pp. 313-314. E. Hospitalier.

Zeitschr. f. Electrotech., 1902, p. 509. E. Edler.

Elektrotechnische Zeitschrift, June 5, 1902, pp. 508-510.

Atti dell' Assoc. Eletro. Italiana, October, 1903, pp. 575-587; February, 1904, pp. 39-42.

Elektrotechnische Zeitschrift, March 31, 1904, pp. 264-270; June 2, 1904, pp. 445-447; Aug. 11, 1904, pp. 702-707; April 19, 1906, pp. 395-396; May 10, 1906, pp. 457-465; May 24, 1906, pp. 509-511; July 30, 1908, pp. 745-746.

Formulaire, E. Hospitalier, Paris, 1900.

Die für Technik und Praxis wichtigsten Physikalischen Grössen, Olof Linders, 1904. Leipzig: Jäh und Schunke. 396 pp.

Die Formelzeichen, Olof Linders, 1905. Leipzig. 96 pp.

Transactions of the Council of the International Electrotechnical Commission held in October, 1908.

[1] Proceedings of the International Electrical Congress of Chicago, 1893. See inserted table at end of volume.

Repulsion Motor for Railway Work.

There has recently been brought out a single-phase repulsion railway motor of the Deri type, which is a modification of a motor of the same type built by Brown, Boveri & Company, of Baden, Switzerland, for hoists, etc., and in experimental use on the Stansstad Engelberg Railway. A list of the contracts which the manufacturers have closed for this new type of motor is shown in the accompanying tables.

As the Deri type of single-phase motor has not been used in this country to any great extent, a short account of the principles on which it operates will be of interest. The motor consists of a single stationary primary winding and a revolving secondary winding, short-circuited upon itself along certain axes which are stationary with respect to the primary magnetism. It differs from the plain (Thomson) repulsion motor in requiring twice as many brushes on the commutator. These brushes are short-circuited in pairs.

STATISTICS OF DERI REPULSION MOTORS IN USE OR BEING BUILT.

Line.	Number of locomotives or motor cars.	Number of motors per machine.	Power of each motor in hp.	Voltage.	Frequency.	Speed of motor in r.p.m.	Length of line in km.
Baden State Railways, Wiesental	2	2	500	500	15	225	49.1
Seetal Railways, Switzerland	2	2	50	500	25	600	..
Martigny-Orsieres Railway, Switzerland	4	4	80	500	15	450	19
Parma Tramways, Italy.	20	2	15	400	25	500	10.5
Buer Mine	1	1	5	150	50	1,000	..
E. W. Mark Switching Service	1	2	40	1,000	50	500	..

A diagram of the motor is given in Fig. 1, which shows the scheme for arranging the brushes and inter-connecting them in a two-pole model. The two brushes in line with the stationary primary coil are held stationary in spacing, while the other two are shifted manually for varying the torque. This produces on each side of the armature a pulsating torque, the net result of which is to tend to turn the armature in a common direction. The value of the torque depends not only upon the current, the magnetism in space-quadrature therewith and

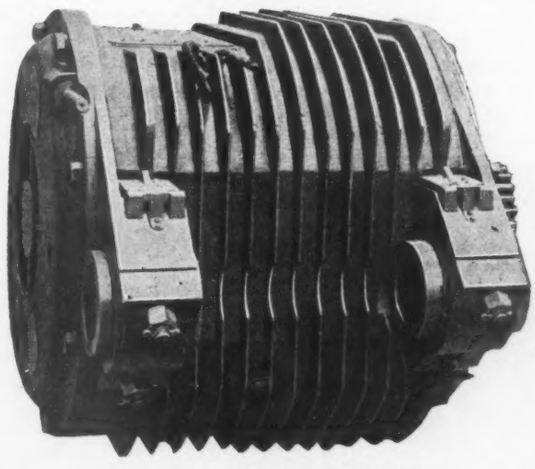


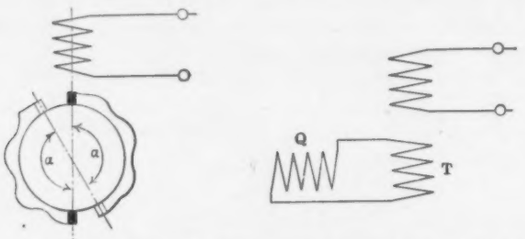
FIG. 1.—DERI TYPE RAILWAY MOTOR.

the cosine of the time-angle between the two, but also upon the space distribution of the coils in which the secondary current is produced.

In dealing quantitatively with the physical relations, it is convenient to consider that the armature winding is divided into two completely superposed armature windings receiving current along two axes separated by an angle equal to the space-angle spanned by the coils actually short-circuited between the brushes. Evidently, the actual condition relating

*The names "gilbert" and "oersted" have never received international recognition. They were only provisionally adopted by the American Institute of Electrical Engineers. †Only T for Deg. Abs. and θ for Deg. Cent.

to the current values will be faithfully represented if each superposed winding is assumed to receive a current equal in value to one-half of the real current in the armature coils. Under the assumed conditions the coils spanned by the brushes will carry the full value of current, while the others will be free from current. One of the assumed superposed arma-



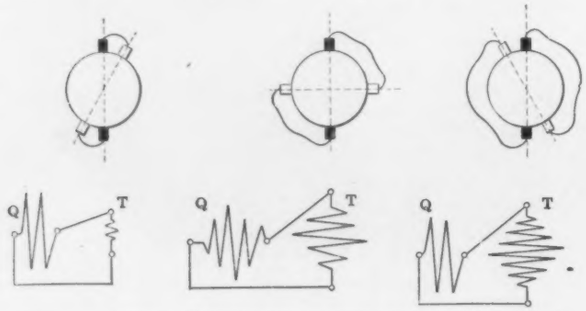
FIGS. 1 AND 2.—CIRCUIT DIAGRAM AND EQUIVALENT TRANSFORMER CIRCUITS.

ture windings has its axis in line with the primary field magnetism, and hence it may be called the transformer winding. The other superposed winding occupies a position depending upon the adjustment of the brushes, but a certain component of the effect produced by the current in this winding is in space-quadrature with the primary field magnetism—the other component being in direct space-opposition therewith, and hence this winding may be called the quadrature coils.

On the basis of the above assumption the connection of the Deri repulsion motor with two brush axes in space-quadrature can be represented as shown in Fig. 2. Any flux produced by the current in the "quadrature" winding will be in time-phase, with the current in the transformer winding, and will produce accelerating torque at the rotor. The time-place relation between the current in the transformer winding and the flux in space-quadrature therewith will not be altered by any motion of the rotor or change in its speed.

Figs. 3, 4 and 5 indicate three positions of the brush axes and show the equivalent connection for the "transformer" and "quadrature" windings on the motor. With the axes close together, the transformer opposing component of the "quadrature" winding is large, so that the resultant "transformer" winding is small, even in comparison with the fairly small space-quadrature component of the "quadrature" winding. With a wider separation of the axes the "transformer" winding produces a greater effect in comparison with the "quadrature" winding. Both when the axes are together and when they are separated by 180 space degrees the torque is zero. In the former case the transformer effect is zero, while in the latter case there is no quadrature effect.

Under speed condition there are produced two e.m.fs., which affect the value of the secondary current, and therefore alter



FIGS. 3, 4 AND 5.—EQUIVALENT CIRCUITS FOR VARIOUS BRUSH ARRANGEMENTS.

the torque, which for each position of the brushes varies directly with the square of the current in the armature. One e.m.f. appears at the "transformer" axis and the other at the "quadrature" axis; the former is proportional to the product of the speed and the quadrature flux, and the latter varies directly with the product of the speed and the transformer (primary) flux. In any event, these two e.m.fs. have such values and time-place position as to tend to decrease the armature current with increase of speed.

It will be seen from the above that the machine possesses the speed-current and speed-torque characteristics of the direct-current series motor. With constant primary e.m.f. and at any set position of the brushes the current decreases with increase of speed, while the torque varies with the square of the current. With the brushes in a constant position at any chosen speed the current varies directly with the e.m.f., but the torque varies only with the square of the current independently of the e.m.f. on the speed at which it may be produced. With constant impressed primary e.m.f. at any given speed the current, the torque and the relation between the current and the torque can be varied throughout a wide range by merely shifting the brushes, as explained above.

Owing to its construction, it is possible to connect the primary winding directly to the high-tension circuit, thus eliminating the necessity for a transformer. Moreover, the regulation of speed, torque and direction of rotation is obtained without the use of a resistance, by the mere movement of the brushes. Thus the machine operates at high efficiency during acceleration, and the acceleration can be made as gradual as desired.

No information has been made public by the manufacturers as to methods for reducing sparking under starting conditions.

Electrical Accidents Around Machinery and Their Prevention.

By Robert J. Young.

THE dangers peculiar to the duties of those engaged in electrical industrial work may be classified under four general heads: (1) Those attributable to shocks; by shocks meaning injury due to the passage of current through the body. (2) Those attributable to burns or injuries caused by burning some portion of the body by contact with an electric arc. (3) Flashes or injuries to the eyes by exposure to the intense light of an arc. (4) Those attributable to falls caused primarily by shocks or burns.

Shocks.—A shock may be received from any electrical circuit provided the body or some portion of it be allowed to form a link in the circuit. No shock can be obtained unless the circuit is completed through the body. This result may follow, however, either by making contact directly to the two sides of a circuit or by allowing the body to form only a part of the connecting circuit from side to side, as, for instance, by standing on the ground and touching one side of a circuit while a ground exists on the other side.

First in order of danger in working on electrical apparatus are the high-voltage transmission circuits carrying power from the generating stations to the works or mills. No work should ever be done upon these circuits or upon any apparatus con-

DANGER
NOTIFY OPERATOR BEFORE DOING ANY WORK ON TABLES CRANES OR OTHER MACHINERY AND ATTACH DANGER SIGN WHERE POWER IS TURNED ON. GET SIGN FROM FOREMAN.
NEBEZPECNO
OZNAMTE OPERATORUM PRI ZACINATE PRACOVAT NA STOLECH CHANOCH ALEBO INACICH MASINACH A DEJ NAPIS, TOM OJE SILA A POSTI PITAJ NAPIS OD FORMANA
VESZÉLY
ERTESITSE AZ OPERATORT MIELOTT NEKIDEL BOLGOZNI TABLEN CHANON VAGY MAS GEPEZETEN ES ADJ VESZELY TABLAT AZON HELYRE HOL AZ ERO MEGSZAKITVA KERJ TABLAT FORMANOTOL
OPAZNO
OBAVJESTI OPERATORA PRIJE NEG POCNES RADITI NA KOJEM GOD STROJU I PRIJE NEGO POCNES RADITI SA ISTIM OBJESI NA STRAJ OZNAKU CUVANJA A ISTI ZNAK U FORMANA
NIEBEZPECZENSTWO
TRZEBA UWIADOMIC OPERATORÓW NIM ROZPOCZNIESZ PRACE NA STOŁACH (DRANIE) LUB INNYCH OPERUJACICH MASZYNACH A ROSTAW NAPIS GDZIE SIŁA PUSZCZY. PYTAC NAPIS OD FORMANA
W. A. FIELD, GENERAL SUPERINTENDENT

FIG. 1.—NOTICE TO USE THE PRECAUTIONS AND PROTECTIVE DEVICES.

nected to them unless the men are absolutely certain that the power has been cut off. With such high voltage the ordinary precautions, such as standing on an insulator or wearing insulated gloves, are of no value. Before doing any work on these circuits the switchboard attendant should be notified by the man intending to do the work, giving him his name at the

same time. When advice is received from the attendant that the power has been cut off the wires between the point where the work is to be done and the power station should be grounded and short-circuited with a chain, one end of which should be placed over the wires after the other end has been thoroughly grounded.

The series arc circuits carrying a high voltage are a source of

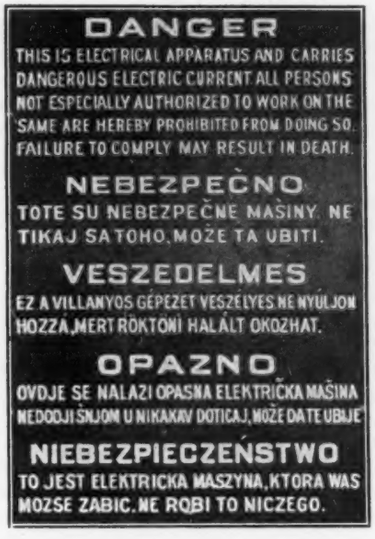

DANGER
THIS IS ELECTRICAL APPARATUS AND CARRIES DANGEROUS ELECTRIC CURRENT ALL PERSONS NOT ESPECIALLY AUTHORIZED TO WORK ON THE SAME ARE HEREBY PROHIBITED FROM DOING SO. FAILURE TO COMPLY MAY RESULT IN DEATH.
NEBEZPEČNO
TOTE SU NEBEZPEČNE MAŠINY. NE TIKAJ SA TOHO, MOŽE TA UBITI.
VESZEDELMES
EZ A VILLANYOS GÉPEZET VESZELYES. NE NYÚLJON HOZZÁ, MERT HALÁLT OKOZHAT.
OPAZNO
OVDJE SE NALAZI OPASNA ELEKTRIČKA MAŠINA NEDODIJI ŠNJOM U NIKAKAV DOTICAJ, MOŽE DATE UBIJE
NIEBEZPIECZEŃSTWO
TO JEST ELEKTRICKA MASZYNA, KTORA WAS MOZSE ZABIC. NE ROBI TO NICZEGO.

FIG. 2.—WARNINGS TO KEEP AWAY FROM APPARATUS.

grave danger. None but experienced men should attempt to work upon them. The greatest danger arises from a possibility of grounds. The leakage alone from the circuit to ground may cause death. The lamp should be cut off by means of the switch. This does not, however, isolate the lamp from the circuit and it should not be touched unless the attendant is standing on an insulator. Before taking hold with either hand he should touch the parts upon which he intends to work gently with the tips of his fingers to make sure he will receive no shock.

Burns.—This class of injury frequently accompanies injury by shock, though it is possible to receive injury by burn even

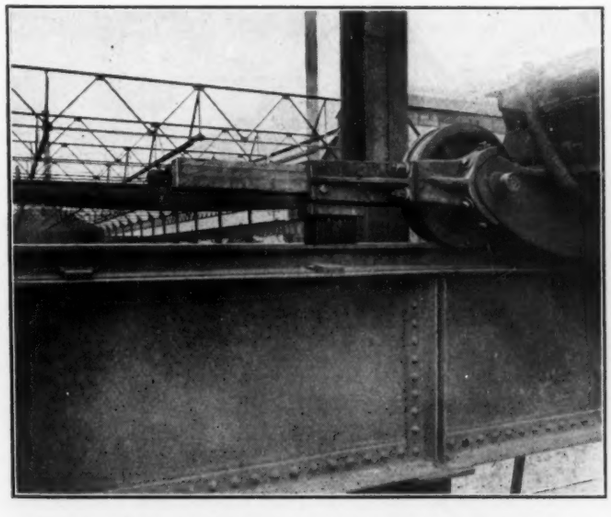


FIG. 3.—SWEEP BRUSHES TO WARN OF APPROACHING CRANE.

where no shock is experienced. Such cases consist in the injured one coming into contact with an electric arc. The most usual cause of an unexpected electric arc is a short-circuit. This may happen in many ways. A lineman may get his pliers across from side to side of the circuit or drop a wire across, or bring two sides of a circuit in contact without knowing that they are of opposite polarities or while thinking they are "dead." The only way to avoid these accidents is to avoid the short circuits. The man working on the circuits should never take any step unless he has full knowledge of what the results may be.

Flashes.—A most annoying, though not deadly, danger exists in the exposure of the delicate nerves of the eye to the intense

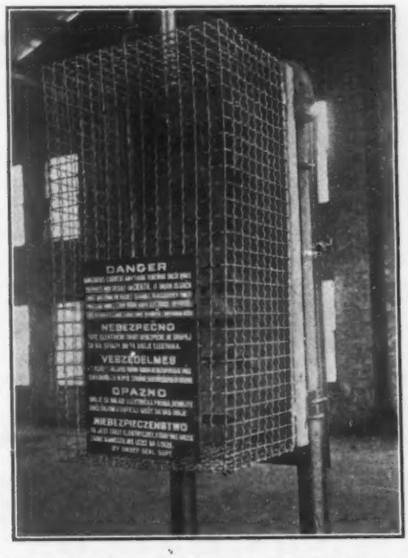


FIG. 4.—GUARD AND SIGN PLACED ON SWITCHBOARDS. BACK OF BOARD PROTECTED BY A PLATE. BOARD GROUNDED.

light of an electric arc, but inasmuch as the injury to the eye does not manifest itself for several hours, it is perhaps well to mention it here so that workmen will not underestimate this danger. Heavy blue or black glasses should always be used when watching an intense light.

Falls.—When an electrical worker is engaged at some point where a fall would be dangerous he should be especially careful not to receive even slight shocks. The surprise of a sudden shock, even though the shock itself is slight, may cause an unconscious contraction of the muscles, which may precipitate a man from a position otherwise secure.

Guarding Electrical Apparatus.—A large percentage of employees injured around electrical apparatus are not connected with that particular work. They may come to grief through ignorance of the dangers or because proper safeguards have not been provided.

The following are a few precautions which have been found very effective:

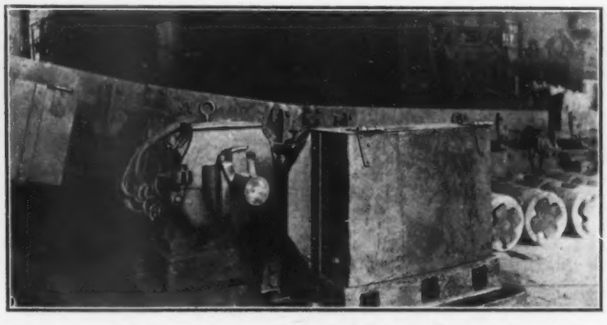


FIG. 5.—CUP PLACED OVER END OF MOTOR SHAFT TO PREVENT CATCHING OF CLOTHES.

All poles and apparatus carrying high voltage and all buildings in which it is generated should bear warning signs calling attention to the dangers. Where there is a large foreign population, such as will be found in most large manufacturing plants, these signs should be printed in the different foreign languages.

Switchboards carrying high voltage and located where work-

men may come into contact with them, should be enclosed to prevent accidental contact and should bear a warning sign printed in several different languages.

Safe disconnecting means should be arranged so that switchboards or switches may be rendered "dead" when necessary to work on them.

The enclosed fuse or automatic overload circuit breaker should be used on all mill motor circuits. There should be insulating mats at all boards.

All motors should be thoroughly grounded. Where the motor is so located that men work around it the armature shaft, if it projects beyond the housing or the brake wheel, should be guarded. A convenient way to do this is to place a cup over the end of the shaft, fastening it to the housing or framework of the motor. It should not be allowed to turn with the shaft. This shaft end has been found to be a prolific cause of accidents.

One of the most productive causes of accidents is the overhead traveling crane.

All overhead cranes should be provided with a railed walk

FIG. 6.—DANGER SIGN IN SIX LANGUAGES.

the entire length of the bridge. It seems strange that manufacturers would build cranes without these walks, but they do. These cranes should also be equipped with foot gongs for the use of the operator; with a box on the bridge in which to keep tools and oil cans, and with limit switches to prevent running the hoist blocks into the drums and probably breaking the cables, allowing the burden to fall onto workmen below.

Each crane should have a switch installed at some point on the bridge which will cut off all power, making it impossible to start the crane from the cab. Many men have been injured while working on the top of a crane by a thoughtless craneman forgetting for the moment that they are there and starting the machinery.

Each man working on a crane should be provided with a "warning sign" bearing his name, which he should attach to the safety switch, warning all not to throw in that switch as he is working on the machinery.

All overhead cranes should be equipped with sweep-brushes extending out from the truck wheels, sweeping the rails, the purpose being to warn a person resting his hand on the rail of the approach of the crane. The number of arms and hands lost by persons working on scaffolds along crane-runways, who thoughtlessly rest against the runway and fail to notice the approach of the crane, is appalling. Four instances have come to my personal knowledge within the past year where these brushes have prevented such accidents.

No man should ever be allowed to go onto an overhead crane runway without permission from his foreman, and then not until the cranemen have been notified and steps taken to protect him from the cranes while he is on the runway.

In going over the reports of State commissioners and factory inspectors it is found that one of the most prolific sources of accidents is electrical apparatus. It is necessarily hazardous in many of its branches, but much can be done to make conditions safer. The foregoing precautions in actual practice have materially reduced the number of these accidents in plants where they have been observed.

The Use of Arrow-Heads in Alternating-Current Vector Diagrams.

By A. S. Langsdorf.

It has been the observation of the writer that students of electrical engineering frequently have trouble in using vector diagrams to interpret the behavior of instruments in interlinked polyphase systems. There is a tendency in analyzing three-phase circuits to use such diagrams as though the vectors represent the space-phase displacements of the circuits involved, whereas they actually represent only the time-phase relations of the quantities themselves. According to the usual convention the vector is supposed to rotate at synchronous speed about one extremity (the unmarked end), so that its projection at any instant upon a fixed axis is the instantaneous value of the quantity represented; the arrowhead simply indicates the "positive," or rotating, end. Whether a given instantaneous value is to be taken as positive or negative will depend upon which *direction* in the circuit is regarded as positive. It is the consistent handling of this underlying assumption, commonly present by implication only, that is essential to a correct solution of the problems referred to. Otherwise stated, the student will find it advantageous to make a particular point of correlating the time relations between the vectors and the physical connections of the circuits in which they act. There is, of course, nothing new in the above statement nor in what follows, but it is thought that the point of view illustrated by a few examples will be found helpful by some students.

If two vectors, E_1 and E_2, Fig. 1, representing two e.m.fs. acting in the same circuit, have between them an angular time-displacement Θ, their resultant is E, according to the ordinary parallelogram law. The physical circuit corresponding to this case may be represented by Fig. 2, G_1 and G_2 being two alternators, or other sources of e.m.f., connected in series. It is well to call attention to the fact that the vector combination of E_1 and E_2 is justified only because these e.m.fs. act in the same circuit.

Suppose that G and M, Fig. 3, represent an alternator and a synchronous motor, respectively. At any instant the generated e.m.fs. of the two machines, with respect to the circuit connecting them, will be nearly opposite, as indicated by the arrows in Fig. 3 and by the vectors in Fig. 4. The resultant e.m.f. in the circuit of the two machines is then e. But suppose now that the two machines of Fig. 3 are alternators in parallel, supplying energy to the line LL, Fig. 5, and that at some general instant the e.m.fs. are physically directed as there indicated. With respect to the circuit LL the vector relation between the e.m.fs. of the two machines must in general be as shown in Fig. 6, e representing, as in Fig. 4, the e.m.f. in the local machine circuit; in Fig. 6, therefore, the parallelogram method of combining vectors (as illustrated in Fig. 1) apparently fails, in the sense that a different signification must be attributed to the arrowheads. Bearing in mind that the physical change from the condition of Fig. 3 to that of Fig. 5 is quite insensible, the difference between Figs. 4 and 6 is due entirely to the fact that the positive space direction in these two figures refers to different circuits. The correct combination of the "time" vectors thus

depends upon a consideration of the physical or space direction of the circuits involved.

Again, consider a three-phase, Y-connected winding, whose vector diagram is shown in Fig. 7. As is well known, the resultant of *Oa* and *Oc* is *ac*, not *Od*. The arrowheads on *a*, *b* and *c* are not to be taken literally, as in Fig. 1, but with due regard to the connections of the phase windings in which the e.m.fs. are generated. It must be remembered that the three vectors *a*, *b* and *c* are supposed to be rotating at synchronous speed about *O* as center, and that their projections on a fixed (vertical) axis are the instantaneous e.m.fs. generated in the three windings; moreover, the positive space directions of the e.m.fs. must be relatively the same in each of the three phases —either from line to neutral or from neutral to line—as demanded by the symmetry of the connections. Thus, if Fig. 8 is a bipolar alternator having three windings displaced from one another by 120 space-degrees, a symmetrical Y-grouping can be obtained only by joining the homologous terminals 1, 2, 3, or 1′, 2′, 3′, the three remaining terminals going to the line. Assuming that terminals 1′, 2′, 3′ are connected at *O*, the circuit from line 1 to line 3 is $1-1'-O-3'-3$; if the direction from 1 to *O* is considered positive, that from *O* to 3 must be negative. Hence, to combine *Oa* and *Oc* (Fig. 7) one of them must be reversed. Assuming that *Oc* has been so reversed, the arrowhead on *ac* will be directed as shown in Fig. 7; though it might equally well be oppositely directed, corresponding to the reversal of *Oa* instead of *Oc;* but in either case the arrowheads on *ab* and *bc* must follow the same convention—that is, the vectors must be grouped in pairs and *in cyclical order*. This will result in the progressive direction of the arrowheads of the delta, Fig. 7, as must needs be the case from the fact that the sum of the instantaneous values of the line e.m.fs. must always be zero.

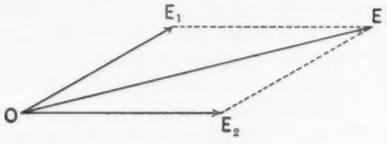


FIG. 1.—ORDINARY VECTOR COMBINATION.

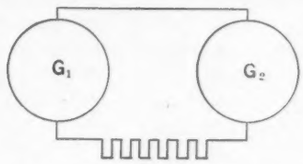


FIG. 2.—ALTERNATORS IN SERIES.

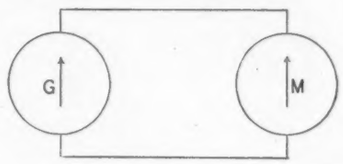


FIG. 3.—ALTERNATOR DRIVING SYNCHRONOUS MOTOR.

An interesting application of these simple principles is afforded in the case of power measurements in a balanced three-phase circuit supplying energy to an inductive load of power factor cos Θ. Let Fig. 9 represent the connections, *W* being an indicating wattmeter with its series coil in one lead and its shunt coil arranged for connection between that lead and each of the two remaining ones; and let Fig. 10 represent the time-phase relations between the various e.m.fs. and currents. Since current i_1 and e.m.f. e_{1-3} appear in Fig. 10 with their arrowheads in the same general direction—that is, with an acute angle between them; and since i_1 and e_{1-2} enclose similarly an obtuse angle, it would appear at first glance that the wattmeter would read, respectively, positive and negative with its potential coil across lines 1 — 3 and 1 —2. Both readings are, however, of the same sign, provided cos Θ is greater than 0.5, which may be understood from the following considerations:

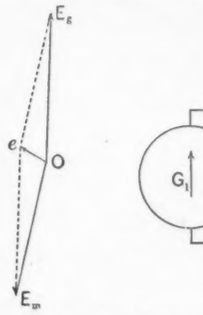
Considering a general instant when the current in line 1 is positive—that is, from left to right (Fig. 9) assume that when switch *S* is down the current in the shunt coil is likewise positive, and that this tends to produce a positive deflection of the instrument. This is equivalent to saying that the direction from line 3 to line 1 is the positive one; therefore, following the lines in cyclical order, the direction from line 1 to line 2 is also positive. But reference to Fig. 9 shows that when *S* is in the up position the direction from line 1 to line 2 through the volt-coil is from right to left, or negative; consequently, if the first reading is

$$W_1 = EI \cos (30 - \Theta),$$

the second will be

$$W_2 = EI \cos (30 + \Theta).$$

Similar methods may be employed in all the various cases that arise in modern switchboard practice in which shunt and series transformers are used in connection with indicating and integrating instruments. It then becomes possible to analyze the behavior of any combination and to design the connections for any desired result.



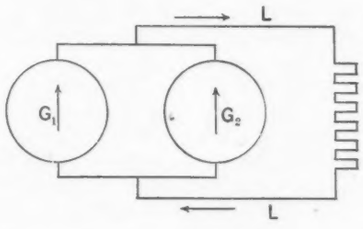
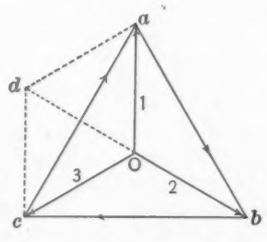


FIG. 4.—E.M.F. VECTORS. FIG. 5.—ALTERNATORS IN PARALLEL.



FIGS. 6 AND 7.—E.M.F. VECTORS. FIG. 8.—Y-CONNECTED ALTERNATOR.

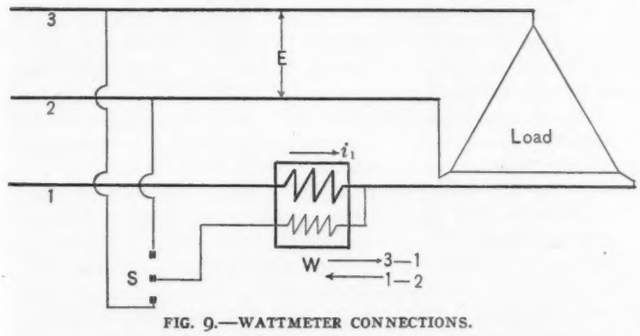


FIG. 9.—WATTMETER CONNECTIONS.

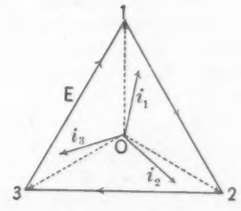


FIG. 10.—TIME-PHASE RELATIONS.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Greenhouse Advertises Itself by Electric Light.

An enterprising florist in Evanston, Ill., calls attention to his business at night by simply illuminating his greenhouse by tungsten lamps and letting the lights burn until 10 p. m., when they are turned out by a private watchman. Sixteen 60-watt lamps are used, and the light shining through the glass makes the building conspicuous and apparently "on the job," to use a slang phrase. There is light enough to readily read the florist's sign.

The greenhouse is not on a main street, but it is on the line of the Chicago & Milwaukee Electric Railway, and passengers on that road cannot fail to see the brightly illuminated glass structure. Attention is thus directed to the proprietor's business, and he is well satisfied with the experiment. The North Shore Electric Company supplies the electricity, the rate being 10 cents per kw-hour for this service.

Electric Iron Campaign in Baltimore.

A vigorous campaign is being made by the Consolidated Gas, Electric Light & Power Company, of Baltimore, for the sale of electric heating units, more particularly electric irons. A hustling force of solicitors has been given separate districts covering the company's customers in its endeavors to introduce these irons into the households of the many users of electricity. A house-to-house canvass has been made, the solicitor with the sample iron ready to prove to the "czars of the laundry" what these wonderful units will really do toward making the summer ironing day one "of beauty and a joy forever."

The policy of the company in leaving the irons on a 30-day trial is meeting with favor on all sides, and the price at which the units are ultimately sold is so low as to bring them within the reach of the most humble householder. The most popular is a 6-lb. iron selling for $3, either cash or in three monthly payments, as the purchaser may elect, payments beginning upon rendition of the first bill following the expiration of the 30-day trial; these special prices have been made only for a limited period.

The company has other methods of bringing this sale to the attention of the public, one by its electric bulletin sign, lighted nightly, whereon the cost and merit of this iron are brilliantly set forth; the other through its main office and showroom where the units are on display to all those who may either seek information or desire to pay their monthly bills.

Although much criticism on account of the low price of the irons, which would ordinarily sell for $5, has been heard from jobbers and contractors, who maintain that the selling of supplies should be separate and distinct from the lighting business and should not be encroached upon by the central station, yet the company believes that the irons are not only increasing the daily energy consumption, but are creating a demand for something by which the electrical contractor and jobber will ultimately reap the benefit.

Gas Lighting Superseded by Tungsten Lamps.

A recent addition to the growing list of mercantile establishments where tungsten lamps have supplanted gas light is afforded by Rosenberg's department store in Evanston, Ill. Formerly this establishment was lighted by a variety of lamps, including arc lamps, glower lamps, ordinary incandescents and 76 gas lamps. But the owner has entirely changed his lighting equipment, using tungsten lamps throughout and taking out all other sources of illumination. The store is now lighted by 90 four-light tungsten clusters, the lamps being of the 60-watt size. There are also about 100 60-watt tungsten lamps in the 250 ft. of show windows which form a part of the store. The proprietor redecorated his ceiling to get the best surface for lighting reflection when making the change. He makes his own lamp renewals. He now has no gas bill at all for lighting, and although his bill for electricity has been increased about 50 per cent, he nevertheless is making a saving of about $60 a month in his lighting bills. The North Shore Electric Company supplies the electrical energy, and is also pleased at the change, getting a long-hour customer who uses nothing but electricity. The store is uniformly and brightly lighted by the tungsten lamps.

Protection from Lightning.

At the Ohio Electric Light Association convention, July 14, Prof. E. E. F. Creighton, of the General Electric Company, gave a talk, accompanied with demonstrations, on "Methods of Protecting Apparatus from Lightning." He said that the static charge which accumulates on lines by the passing of hail, rain, fog and dust across the wires is easy to dispose of simply by placing a very high resistance between lines and ground, which is sufficient to drain off the static charge as fast as it accumulates. He mentioned one peculiarity of resistance sticks of graphite. These show a lower resistance the higher the voltages that are applied to them. This is supposed to be because the graphite resistance stick is really a conglomeration of conductors, mixed in with non-conducting material, and when high voltages are applied the current jumps across at more points than with a low-voltage applied.

The apparatus which Professor Creighton had for demonstration consisted of an induction coil capable of giving a 16-in. spark. For the purpose of showing the effect of lightning discharges which are of very high frequency, this coil had its terminals connected to Leyden jars and the other terminals of these jars were connected to the needle points which were used for indicating the discharge voltages during the tests. The frequency of the oscillations in the discharge thus produced, he said, was approximately twice that obtained with lightning discharges. The frequency of lightning discharges is usually considered to be between 500,000 and 1,000,000 vibrations per second.

A small choke coil was connected in shunt with the needle points, and he moved the needles together until a discharge took place. The length of this discharge is a measure of the resistance offered to the passage of the high-frequency discharge.

It was shown that even with one or two turns of a choke coil in shunt with a spark-gap the discharge would jump over a considerable gap rather than round these turns, thus strikingly illustrating the efficacy of choke coils in circuits between apparatus and lightning arresters. These choke coils, although having but little effect on the low-frequency dynamo current, have a very pronounced effect on high-frequency lightning discharges. A spark 0.5 in. long was obtained in shunt with a 7-in. loop of wire, thus showing that the high frequencies employed in this test would jump 0.5 in. before going around a 7-in. loop. Other demonstrations along the same line were given. He explained that in any arrester of the type which depends on sparking between metals there will be a heavy flow of dynamo current if there is sufficient discharge to volatilize much metal.

In answer to questions following his demonstrations, Professor Creighton said that the multi-gap arrester is sensitive to lightning discharges, but not to the surges which take place due to short-circuits. At the present time lightning arresters in

stations are desirable for the protection of apparatus, but it is not commercial to use them all along transmission lines. The multi-gap arrester is the preferable form for low-tension distributing circuits, and the aluminum cell for high-tension transmission lines.

Answering a question as to the effectiveness of the horn spark-gap arrester with the resistance in series to limit the current, he said that if enough resistance is placed in series to prevent the shutting down of the system by the excessive line current following the discharge, the resistance would be so great that it would not allow a sufficient flow to dispose of the discharge of lightning properly. The aluminum cell arrester, on the other hand, is like a safety valve in that it allows no discharge up to a certain voltage, and offers a very low resistance path to the discharge in excess of the predetermined voltage. This prevents an excess of current on the generator, because the only current flowing through the arrester is the excess caused by the lightning discharge.

INTERIOR WIRING AND ILLUMINATION

Special Electric Illumination at Salem, Mass.

Electricity contributed largely to the enjoyment of Old Home Week this year at Salem, Mass. The Salem Electric Lighting Company installed about 3500 extra incandescent lamps in the park and residential districts, notably at Salem Willows and Juniper.

The new U. S. scout cruiser *Salem*, which lay off shore a few hundred feet, was also specially illuminated. A crowd of about 50,000 persons witnessed the special electric lighting, which included a large amount of store-window work. The company made extra preparations to carry the additional load without interruptions, and not the slightest difficulty in this direction was encountered. General Manager S. Fred Smith states that a still larger load could have been handled satisfactorily.

Meter Location.

BY G. E. PALMER.

The necessity of maintaining apparatus of a delicate nature on premises not controlled by the operator has contributed largely to the unsatisfactory results attending the use of watt-hour meters, as the successful operation of this class of electrical apparatus is dependent entirely upon frequent and accurate testing.

As the subject of properly metering the use of electricity is at present one of the most important engineering and operating problems confronting the central stations of the country, it appears that a discussion of this subject will be of more than passing interest.

As the purpose of this article is more to comment on the prevailing poor conditions rather than attempt an academic discussion of the subject, it is merely necessary to touch, in a very perfunctory way, on the prime causes of meter inaccuracies.

Briefly considered, there are a number of meters on the market of standard design and manufacture that, when properly installed and regulated, measure the use of electricity with greater accuracy than will be found in any commercial measuring apparatus in general use. That these results do not obtain in ordinary practice is evidenced by the fact that a combined record of all obtainable tests gives an average of 8 per cent loss on all speeds of meters for the entire country—results that show conclusively a lack of frequent and proper testing.

Assuming the cost of the generating equipment to be $12 and of the metering equipment $8 per kw—figures that are practically correct for stations of moderate size—it is a wonder how the foundation or setting for watt-hour meters could have been so generally forgotten when so much ability has been brought to bear on the subject of generator locations. Both devices have rotating elements and depend upon perfect bearings and lubrication and freedom from dampness and dirt to insure their proper operation: both require the most skilful adjustment before they are placed in service and, in addition to these similar characteristics, the watt-hour meter must perform its duty perfectly through all ranges of speed and should be able to perform its regular functions when the generating equipment is not maintaining ideal conditions of potential and frequency.

For a number of years meter locations have been generally improved, but with the exception of a few of the larger companies, the general practice has been to mount the meter on a wooden board supported on a wall or partition of the customer's premises and as nearly as possible to the service entrance. Then it was demanded of the contractor that a loop be left which would enable the station wireman, assited by a blow-torch, two kinds of tape and a few feet of flexible conduit, to complete a job of meter connection that would be a credit to the workman only until after the meter had been subjected to the regular installation and commercial test.

It is quite true that a number of central stations insist that a definite arrangement of meter leads be maintained, but when an open-wire system is in vogue the maintenance of appearance in this wiring adds very materially to the cost of meter inspection.

The meter, placed on wood, is subjected to the strains due to the effect of changes in temperature and the gradual shrinkage of its base; its wires are exposed to illegal manipulation and any attempt to give its connections an orderly appearance simply makes more delay to the operation of testing.

It surely seems that such an expensive piece of apparatus as the electric meter should have a more definite location than is ordinarily accorded it, and it is interesting to note that a number of manufacturers are in the market with devices designed to facilitate the installation, test and replacement of meters. All of the devices examined by the writer are certainly steps in the right direction. The most essential features in an arrangement for this purpose should include terminals for service and house wires that may be approached from any direction without crossing leads, and terminals to which the meter leads may be readily connected or disconnected; a base or location on which it is possible to set any meter within the probable wants of the service without making any changes in the wiring, means for testing without interfering with the wiring or the customer's use of electricity, and an enclosing box that will allow the service wires to be carried in conduit into and out of the meter so that neither the meter nor connecting wires may be altered without breaking the seal.

When the meter is provided with the above surroundings and accessories it is practicable for the meter-testing force to improve greatly the quality of their work and so reduce the cost of meter testing that it is possible to make more frequent tests when they may be found necessary without increasing the cost of the department. Furthermore, meters can be quickly replaced without the use of any tool other than a screw-driver, and as tests may be made without interfering with the customer's lamps in service, the meter-testing force is not compelled to work on a short-hour schedule during the winter months.

It is to be noted also that the subject of energy theft ceases to be a topic of vital interest when all wires on the line side of the meters are protected by a conduit in such a manner that it is possible to obtain unmetered service only by manipulating the seals on the meter itself.

During the coming year a great deal of work will be done in improving the condition of meter location, and the next annual report of the meter committee of the National Electric Light Association in a further elaboration of this very interesting subject will probably contain much valuable information along the lines indicated above.

of consumers supplied by each transformer in a diagram. For values of x above 5 the diagram is represented by the formula $y = 2.6 \log x$ is derived, where y is the ratio of the total kilowatts connected to the maximum load and x the number of consumers. If every individual consumer's maximum load was equal to his total possible or connected load, then y would represent the diversity factor. Since, however, each consumer's maximum load is nearly always (for private houses) less than his possible load, y must equal the diversity factor multiplied by some number A. The diversity factor equals therefore 2.6 $\log x$ divided by A. A is the average value of the ratios of the connected kilowatts to the maximum demand of all the consumers and is thus approximately a constant. Taking A to be 1.5, the diversity factor becomes 1.7 $\log x$. The author then shows diagrammatically the reduction in the (general) diversity factor by adding a shop lighting load to a private house lighting load. The private house diversity factor is assumed as 3 and the shop diversity factor as 1. If the shop and private house maximum loads are equal, the diversity factor is half what its value would be if the load consisted of private houses only. The author concludes that the price per unit charged by any supply authority for lighting must depend on what proportion the shop lighting bears to the total lighting. Both on account of diversity factor and load factor shop lighting must be more expensive than private house lighting. The difference in load factor is, of course, allowed for if the maximum demand system of charging is employed.—Lond. *Electrician,* July 16.

Leakage Indicator for Mines.—A note on a recent British patent (17,161, 1908; July 15, 1909) of the Ashington Coal Company and T. McKie for a leakage indicator for mines. In this arangement, which is adapted to three-phase systems, a separate leakage return circuit to the neutral point of the main generator is provided to each main circuit, so that the leakage current flows through a coil which actuates a drop weight for knocking off the main switch or similar releasing device. The leakage current also actuates a tell-tale, or indicator, on each leakage circuit, which closes a relay circuit controlling a lamp indicator in the generating station. A recording ammeter is placed in the main leakage return circuit and also a choking coil and fuse.—Lond. *Elec. Eng'ing,* July 22.

Wires, Wiring and Conduits.

Transmission Line Constants.—The first set of a series of tables of transmission line constants, compiled under the direction of D. B. Rushmore by M. W. Franklin. The present installment contains tables for the self-induction of solid conductors, the capacity of solid conductors, and the inductive reactance of solid conductors for 25, 60 and 100 cycles. The tables are carried to the fourth and fifth place, and the calculation is based on exact formulas.—*Gen. Elec. Review,* July.

Hard-Drawn Copper Wire.—Standard specifications for hard-drawn copper wire, as proposed by a special committee of the American Society for Testing Materials.—*Gen. Elec. Review,* August.

Electrophysics and Magnetism.

Radiations.—W. S. Andrews.—A lecture in which beginning with a general discussion of ethereal waves the author passes to a description of the known waves of greatest length; i.e, the Hertzian waves, having a frequency of the order of millions per second. He then takes up in the order of increasing frequency the infra-red, or heat waves, with an approximate frequency of from 20 to 365 million millions per second; the visual light waves, which have a frequency of from about 365 to 800 million millions; the ultra-violet waves, of from 800 to 3000 million millions; and, finally, the group of waves of exceedingly small wave length and enormously high frequency, to which the X-ray ethereal pulses and probably the gamma rays of radium belong. All these rays cover a total range of possibly 40 octaves or more.—*Gen. Elec. Review,* July.

Selenium.—Louise S. McDowell.—An experimental investigation of the diminution of the resistance of selenium under the action of light, and especially of the recovery curves—that is, the curves which show the rate of return to the normal dark resistance after exposure to the light has ceased. The chief results are as follows: The form of the recovery curve depends on the intensity of the excitation and on the wave-length of the exciting light. In general the time of recovery increases with the intensity of the excitation. Recovery is slower for excitation by infra-red light than by light of the visible spectrum. Individual cells differ in the relative time of recovery for different wave-lengths as well as in the absolute time of recovery for light of the same intensity and wave-length. The effect of increased duration of excitation upon the form of the recovery curve is similar to the effect of increased intensity. Excitation requires time. While from 60 per cent to 80 per cent of the entire increase in conductivity may be produced in the first five minutes, for complete saturation hours are required. The rate of excitation varies with the intensity and the wave-length of the exciting light. The time required for complete saturation may decrease as the intensity of the light diminishes, but the initial rate of excitation increases with the intensity. The variation in the rate of excitation of the individual cells for the different wave-lengths corresponds to the variation in their rate of discovery—for example, those cells which show the most rapid recovery for red light show also the most rapid excitation for red light. The relation between the resistance and e.m.f. is approximately a straight-line relation. The resistance decreases as the e.m.f. increases. Different cells show a variation in the relative sensibility to light of different wave-lengths, but no relation was found between this variation and the variation in the curves of recovery and excitation. Electric oscillations affect the resistance and hence the sensibility of the selenium cell. These effects are of two kinds—immediate and deferred. Both may be in the nature of coherer effects and both depend upon the condition of the cell at the time when the oscillations are applied.—*Phys. Review,* July.

Photoelectricity.—J. Elster and H. Geitel.—An investigation of the emission of electrons from surfaces of alkali metals, as influenced by the condition of polarization of the exciting light. More negative electrodes are emitted by light polarized perpendicularly to the plane of incidence than by light polarized parallel to the plane of incidence. The maximum speeds of the electrons are the same in both cases, but the number of electrons with a certain speed below the maximum is greater in the first case than in the second case.—*Phys. Zeit.,* July 15.

Photoelectricity.—F. K. Richtmyer.—An article on the dependence of the photoelectric current on light intensity. The chief result is that the photoelectric current from a metallic sodium surface at zero potential, under the action of light from an incandescent lamp is strictly proportional to the light intensity for ranges of intensities from (approximately) 0.007 to 0.5 foot-candle.—*Phys. Review,* July.

Electrochemistry and Batteries.

Induction Furnaces.—G. Gin.—An illustrated Faraday Society paper describing "automatically circulating induction furnaces" in which inclined passages for the charge are provided so as to produce an automatic movement of the charge due to the differences of specific gravity.—Lond. *Electrician,* July 9.

Purification of Water by Ozone.—R. Rideal.—A paper read before the Royal Sanitary Institution in London on the successful use of De Frise-Siemens ozonizers for the purification of river water at Paris.—Lond. *Electrician,* July 9.

Units, Measurements and Instruments.

Projection Rheograph.—An illustrated description of the Abraham double-projection rheograph for demonstrating wave forms, etc. It consists of two parts (see Fig. 3), a double galvanometer, G_1 and G_2, and a synchronous motor S. In the standard instrument the two galvanometers are identical and entirely independent of each other. The moving part of the galvanometer consists of a small rectangular frame of aluminum (A in Fig. 4), closed upon itself, about 38 mm long, 6 mm wide and 0.9 mm thick, carrying upon it the comparatively large mirror B of area 48 sq. mm. The aluminum frame is suspended by means of a very thin silver wire W, in the

field of a permanent magnet *C*, the wire being so thin as to exert practically no torsional control. The frame forms the secondary of a small transformer, the primary *D* consisting of several turns of wire, while a laminated core of soft iron *E* carries the flux through the secondary. The two ends of the

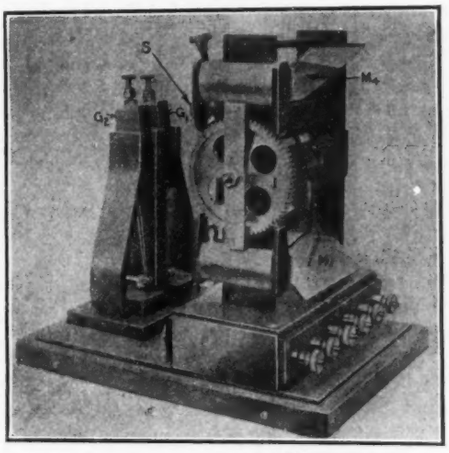


FIG. 3.—PROJECTION RHEOGRAPH.

fixed or primary windings are brought out to the terminals on the front of the instrument. To study the wave form of a given current or potential difference it is necessary to arrange that a current in time and space quadrature with it should be passing through the primary winding of the oscillograph. If the wave form of a potential difference is being studied, then

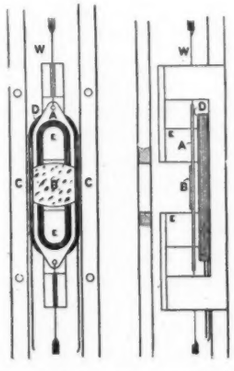


FIG. 4.—DETAILS OF CONSTRUCTION.

a condenser is placed in series with the oscillograph, or if a current curve, then a small series transformer is used; the current under investigation is passed through the primary, the secondary being closed through the oscillograph. The resistance of the secondary of this transformer is purposely made high so that the induced current will be in time quadrature with the main current, and not in opposite phase. The current

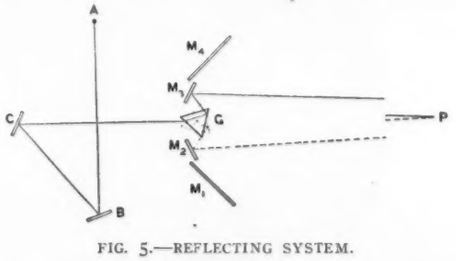


FIG. 5.—REFLECTING SYSTEM.

in the suspended aluminum frame is produced entirely by induction from what is practically a small transformer in the oscillograph itself. This transformer has been so designed that the flux is proportional to the ampere-turns without the hysteresis of the iron exerting any material influence. The current produced in the moving system is proportional to the rate of the change of the current in the primary of the rheograph. With proper design it can be so accomplished that the deflection varies directly as the current. The synchronoscope is a form of synchronous motor used to project vertically upon the screen, and proportionately to the time, the horizontal movements of the beam of light from the mirrors of the two galvanometers. It consists of a equilateral total reflecting prism (see Fig. 5) mounted on a horizontal axis, a simple toothed iron wheel *I* (Fig. 3) forming the rotor of a synchronous motor being mounted on the same axle. The motor operates at frequencies of from 40 to 90 cycles without difficulty, making one rotation per second when the frequency is 36. If the prism alone were used only three reflections per second would be given, and these would not be sufficient to produce an appearance of continuity on the screen. Abraham has, therefore, introduced four mirrors to increase the number of reflections to 12, this number being sufficient to give an appearance of almost perfect continuity. Two of the mirrors are clearly shown in Fig. 3—namely, M_1 and M_4. The beam of light from the arc lamp *A* (Fig. 5) is thrown by the small mirror *B* onto the galvanometer *C*, is reflected from that on the prism *G*, is again reflected onto one of the fixed mirrors *M*, and from that onto the screen at a point *P*. If the prism is rotating in the direction of the hands of a watch, then the beam of light will be reflected from the mirrors M_1, M_2, M_3 M_4 respectively. The diagram shows the beam reflected from the mirrors M_2. The applications of the instrument for studying the curves of an e.m.f., or the curve of a current, or the variation of the flux in a magnetic field, or the use of the instrument as a ballistic galvanometer, are described.—Lond. *Electrician*, July 9.

Reichsanstalt.—An abstract from the annual report for 1908 of the electrical work performed at the German Reichsanstalt. Notes are given on the constancy of manganin coils, the preparation of standard cells, the tests of dry cells, aluminum electrolytic condensers. Of a series of 24 carbon-filament lamps tested on a 234-volt, alternating-current circuit, 15 were still usable after having burned for 2000 hours. In another series of 24 metallic-filament lamps (12 for 110 volts and 12 for 220 volts) half the number of each voltage were tested in a vertical position, the other 12 being at an angle of 45 deg. to the vertical. They were run on alternating current. It was rather surprising that the latter batch showed a longer life than those hanging vertically. A number of tests were carried out on various forms of flicker photometer which could be used on a straight photometer bench, with a view to determining whether the use of the flicker photometer is to be advocated for test purposes. It was found, however, that this form of photometer offered to the skilled operator no advantage over the usual method of measurement as regards rapidity and certainty of adjustment.—Lond. *Elec. Eng'ing*, July 22.

Telegraphy, Telephony and Signals.

Wireless Telephony.—M. COLIN AND R. JEANCE.—An account of experiments on the production of simple undamped oscillations of constant energy for wireless telephony. For this purpose very stable arcs are required and they are obtained by the arrangement of the negative electrodes, which consist of very thin pencils of carbon carried in a support with a large radiating surface. The positive electrodes are large copper cylinders with flat ends, water-cooled from the inside. To produce a simple oscillation the authors make use of an intermediate current.—Lond. *Electrician*, July 9.

Miscellaneous.

Electric Accident.—At the inquest recently held in England upon the death of two men who were killed by electric shock it was elicited that the shock was obtained from an electric coal-cutter working at 550 volts, three-phase. An abrasion in the insulation of this stator winding caused contact to be made with the frame of the machine, and although the trailing cable contained a fourth wire for earthing, the connection between this and the machine was defective.—Lond. *Elec. Eng'ing*, July 22.

BOOK REVIEW.

TRANSFORMERS FOR SINGLE AND MULTIPHASE CURRENTS. A Treatise on Their Theory, Construction and Use. By Gisbert Kapp. Second edition, revised and enlarged. London: Whittaker & Company. 363 pages, 219 ills. Price, $3.

Electrical engineers are glad to welcome the second revised edition of Mr. Kapp's small book on transformers. The first edition of this work appeared in 1895, as the result of a course of lectures delivered by Mr. Kapp in the winter of 1894 on the theory and the design of transformers. The little book grew out of this course of lectures and it is now submitted to us with considerable interesting and valuable additions.

Few engineers of the younger generation realize or appreciate the remarkable work accomplished by Mr. Kapp in the 15 years from 1880 to 1895. He taught that generation of engineers who developed and perfected alternating-current generators, motors and transformers. He enunciated the principles, explained, expounded and applied the theories of Thomson and Maxwell to dynamo design and engineering practice. Always deeply interested in engineering problems, and profoundly in earnest, nothing could have been more instructive than a colloquial controversy between him and such men as Dolivo Dobrowolsky and Brown. One could not leave such discussions without having been set to thinking and having received the most fertile suggestions.

Mr. Kapp's great work belongs to the first half of the score of years just passed. In this period he taught the use of the characteristic saturation and regulation curves, of direct-current and alternating-current generators. With Swinburne, he showed the effect of armature reaction with lagging and leading currents, and explained, by means of vector diagrams, the use of overexcited synchronous motors as "power-factor rectifiers," as he called them in 1893, now 16 years ago. His earnestness and his unwillingness to accept specious explanations and half knowledge led him to investigate the "Ferranti Phenomenon," 20 years ago, and his contribution to this subject before the Physical Society of London is a classic in our art.

The little book on "Transformers" has grown since 1894. Much new valuable matter has been added, but also much obsolete matter has been retained. For instance, Fig. 20, representing a Westinghouse transformer plate, Figs. 61 and 62, and Figs. 193, 194 and 195, are only of historic interest. In showing electrical designs it is essential to follow closely the development of the times, as designs antiquate soon and are apt to be misleading to beginners and inexperienced engineers.

There are a number of subjects upon which full information would have been welcomed at the hands of the author, whose ability to present complex subjects lucidly is unrivaled. The theory of eddy currents in solid conductors is omitted, although of the greatest importance in the design of modern transformers. The mechanical forces between coils should have been discussed, as they are of growing importance, and the designer has to provide against the effects caused by them. The extra insulation between turns near the terminals of transformers for high potential is another subject of which Mr. Kapp has not treated. Since we are talking of the shortcomings of the book, we call attention to diagram IV, Fig. 113, showing Dr. Behn-Eschenburg's method of measuring the power of a three-phase circuit, which is correct only for balanced and not for unbalanced circuits.

Against these few and unimportant criticisms there stands out a wealth of information, an outline of fundamental principles with application to practical problems, unrivaled in clearness and simplicity. The measurement of alternating-current power, the correction factor of wattmeters, the testing of transformers, the fluxometer, rise of pressure through resonance—these are some of the chapters the study of which will repay both students and engineer. This work of Mr. Kapp is indispensable to the electrical engineering profession.

NEW APPARATUS AND APPLIANCES

New Electric Delivery Wagon of the Commonwealth Edison Company, Chicago.

Favorable attention has been created by the appearance in the Chicago streets of the new type of electric delivery wagon

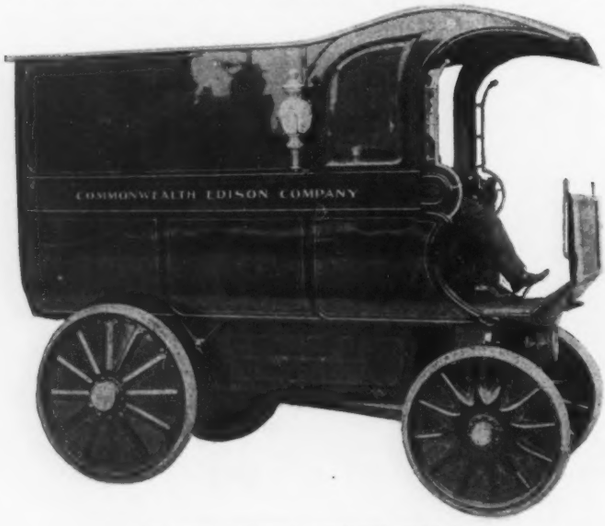


FIG. 1.—ELECTRIC DELIVERY WAGON.

belonging to the Commonwealth Edison Company and used in the delivery of purchases made at "Electric Shop," the Michigan Avenue salesroom of the company. This wagon, which is illustrated in Fig. 1, is not only of handsome appearance, but it also has a record of great efficiency in operation. The exterior finish is dark green with brass trimmings with plate-glass windows at the sides and in the rear. There are artistic side lamps, as shown in Fig. 1, and an electric search lantern is mounted beneath the dashboard. The vehicle has a carrying capacity of 3000 lb. and its normal speed is 14 miles an hour. The battery consists of 40 eleven-plate cells and it supplies electrical energy to one 4-hp, 80-volt electric motor mounted on the rear axle. The driving gear is of the new type known

FIG. 2.—REAR DRIVING WHEEL, WITH OUTER DISK REMOVED.

as the Walker balance gear which is made by the Automobile Maintenance & Manufacturing Company, of Chicago. Disk

wheels are used and they are provided with solid tires 42 in. in diameter, 3½ in. wide for the rear wheels and 36 in. in diameter and 3½ in. wide for the front wheels. The wheel base is 88 in. and the gage of the vehicle is 56 in. Four forward and reverse speeds are available and the brakes are of the external-band type, applied on the rear wheels. The steering is accomplishd by a side lever.

Fig. 4 is a view from beneath showing the construction of

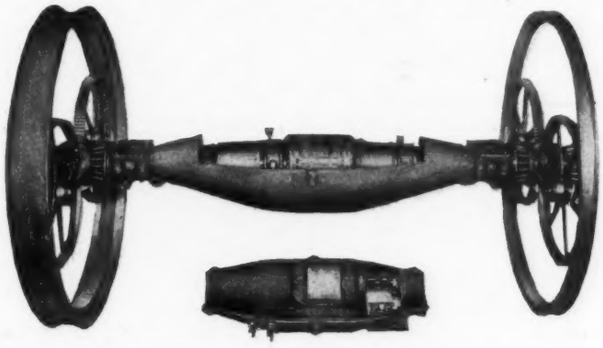


FIG. 3.—BALANCE GEAR AND MOTOR HOUSING, WITH COVERS REMOVED.

the wagon. The absence of complicated driving mechanism is evident. As stated, the driving gear is of the Walker balance gear type and the design and application of this method of gearing may be readily understood by reference to Figs. 2 and 3. This gear is unique in that the motor and rear axle are integral. The diameter of the rear axle motor housing is 11⅝ in. The rear wheels are of the disk type, as previously mentioned, with disks pressed cold out of sheet steel, and the gears are inclosed within the space between the two disks of each wheel, as clearly shown in Figs. 2 and 3. This construction is proving highly efficient both in relation to energy consumption and maintenance cost. All driving gears are of the spur type and run in oil. All bearings are either of the Hess-Bright ball type or the Timken roller type. There is no side thrust on the armature bearings.

As shown in Fig. 3, a portion of the upper half of the motor housing on the rear axle is removable, affording ready access to the armature and differential gear. The ends of the housing are bored out to admit cast-steel yokes, which support the rear-wheel bearings and hold the idler gears, which are placed between the driving pinions and the large internal gears, mounted on the tire channels.

The power transmitted by the driving pinions is equally dis-

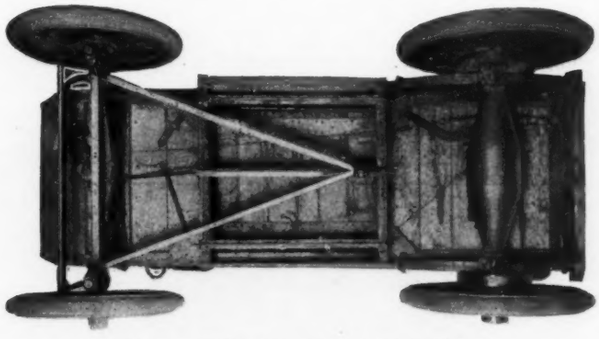


FIG. 4.—UNDERPART OF DELIVERY WAGON.

tributed to the idler gears, which, in turn, distribute it equally to the internal gear of the driving wheel. Power is thus transmitted from the motor armature practically without loss to the rims of the rear wheels and through mechanism entirely encased. It is believed that this construction is particularly favorable to long life as well as to efficiency. The wagon is almost noiseless in operation. It is particularly serviceable in crowded streets, as it can be turned completely around in a circle having a diameter of 25 ft.

In daily operation the wagon is making runs of from 40 to 60 miles on one battery charge. It has been driven 76 miles on one battery charge. The battery is charged only at night at the Commonwealth company's garage at 138 South Morgan Street, where 15 electric wagons are housed, all of about the same size, but not of the same type, as the one illustrated.

Each wagon is equipped with an odometer and a Sangamo amp-hour meter. The application of the latter instrument to electric automobile operation is comparatively new, but it seems to be meeting with favor. The instrument registers the actual number of amp-hours of battery discharge during the day's travel. Thus the driver, knowing the approximate output of his battery, can see at a glance at any time the amount of available energy remaining. He is in no danger, therefore, with ordinary judgment of getting caught on the street without sufficient energy left to carry him back to the garage.

Outlets for Knob and Tube Work.

The accompanying illustrations show applications of an outlet made by the Union Electrical Manufacturing Company, of Akron, Ohio, and approved by the Underwriters. The device is especially useful in knob and tube work and can be quickly

FIG. 1.—OUTLET ATTACHED TO JOIST.

attached directly to the joists and studding where outlets are required for switches and lamps. It is applicable for all standard makes of surface snap switches, wall sockets, rosettes, wall brackets, etc. The arrangement of the holes provide five different sizes corresponding with the screw holes in switches,

FIG. 2.—VIEWS OF OUTLET.

rosettes and wall sockets. The bracket is provided with a threaded opening from which the smallest to the largest chandeliers can be firmly suspended. The bracket can in most cases be quickly attached directly to the joists and studding, and the

wires can be spread as desired. If it is necessary to use two switches at the same place, one bracket is placed above the other on the same studding. For three-point switches the third wire and tube are entered through the threaded opening.

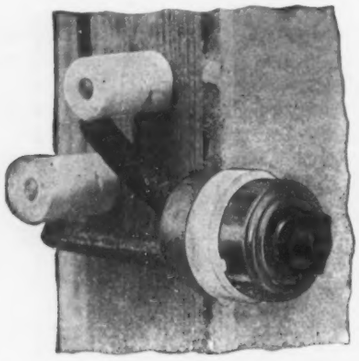


FIG. 3.—OUTLET FOR SURFACE SNAP SWITCH. FIG. 4.—OUTLET WIRED FOR THREE-POINT SWITCH.

It is claimed by the maker that by the use of the "Newhub" outlet bracket, the name by which the device is known, knob and tube work can be installed very rapidly.

Non-Multiple Telephone Switchboards for Central Offices.

In the accompanying illustrations are shown telephone switchboards designed for non-multiple central-office installations, in which compactness, neatness and durability have been given proper consideration, and special attention has been paid to the obtaining of high efficiency of operation and low maintenance expense.

All joints in the woodwork are tongued and grooved, fastened with glue and reinforced with steel angle irons. The key-shelves of the sections are strengthened by steel bars to which the operator's keys are fastened by means of machine screws. This arrangement not only insures a proper alignment for the keys, but permits of their easy removal should occasion require. The key-shelves are hinged by means of a piano-hinge extending the full length of the key-shelf. This arrangement strengthens the key-shelf and plug-shelf and also adds to the appearance of the switchboard. The exterior surface of the sections is given a rich, golden-oak finish. The outer coat of varnish is hand-rubbed and of such a character as not to scratch easily or to show ordinary wear.

The switchboards are arranged in one-position and two-position sections equipped with Bell type of apparatus throughout. Many interesting features will be noted in connection with this apparatus. The combined jack and signal used on the line circuits of the self-restored signal type of switchboard is said to be radically different from any previous design of magneto signal device. The signal is given by means of a revolving steel ball, the visible portion of which changes color when operated. A portion of the surface of this ball projects from the face-plate in such a manner that the signal can be seen from the side as well as from the front. One of the advantages claimed for this type of signal is that there are no projecting surfaces on the face of the board that are liable to injure the operator's hands or tear her clothes. Another feature of this signal is the circular armature that is made use of in order to permit of readily removing the coil from the signal.

By means of the circular armature, none of the line connections is disturbed in any way and no parts of the signal that enter into the adjustment of the same are disturbed when repairs are made. The coil is removed by taking out a single screw. Especial attention has been given to the night-alarm attachment. The circuit for the alarm is completed through two platinum-pointed springs that are attached to each of the signals, which springs make contact when the signal device is operated. These springs are located in an accessible position behind the face-plate so that they cannot be injured by the operator. The keys used are equipped with horizontal

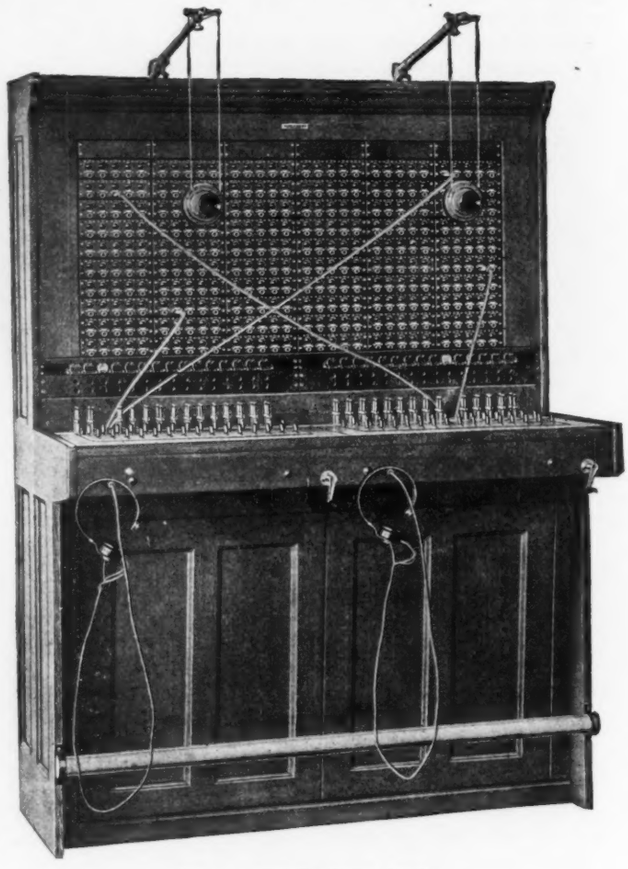


FIG. 1.—TWO-POSITION BOARD.

springs mounted on edge in blocks of hard rubber. The arrangement is such that, upon opening the key-shelf, the trouble-man can ascertain at a glance whether the key-springs are in operating condition, and hence it is seldom necessary to remove the key from the key-shelf.

The variety of conditions that can be met by these switchboards is well illustrated by the fact that there are six different types of equipments for which they are adapted, as follows: Magneto equipment with self-restoring line signals; magneto equipment with manually restored line signal; magneto equipment with electrically restored line signal; magneto equipment

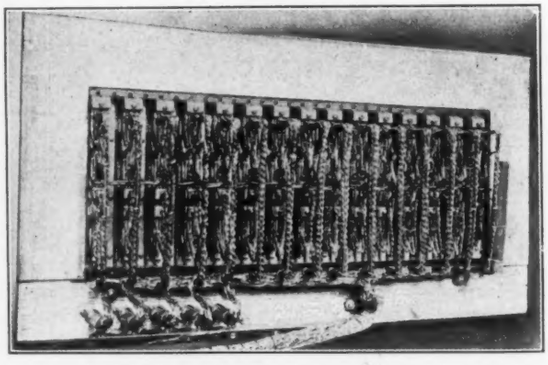


FIG. 2.—REAR VIEW OF BOARD, SHOWING KEY SHELF.

with electrically restored line signal, arranged for conversion to central-battery service; central-battery equipment with magnetic line signal, and central-battery equipment with lamp-line

signal. The magneto switchboards can be additionally equipped with ringers for operation on exceedingly long lines or on lines where audible code signaling is desired, while the central-battery switchboards can be additionally equipped with a combined jack and signal for operation on rural lines.

All of the switchboards can be operated with standard ringing systems, such as one-way, two-way, two-party, four-party pulsating, four-party harmonic, eight-party harmonic, etc. They are also suitable for single or double supervision. The double supervision cord-circuits used in the switchboards are arranged to prevent "ring-through" or "hang-up" difficulties. The switchboards can be equipped with through toll-line circuits (sometimes known as "cut-in stations"), audible code ringing on each of the line circuits, etc.

The above-described apparatus has been placed on the market by the Western Electric Company, which has developed for use with such boards full lines of lightning arresters, cabinets, calculagraph sections, etc.

Reflector for Industrial Establishments.

The reflector illustrated herewith has been developed especially for factory and shop lighting with tungsten lamps. It is of the steel type, the reflecting surface being so designed as to

SHOP TYPE REFLECTOR.

eliminate objectionable shadows. The type of ventilated holder does away with overheating and deterioration of lamps. These reflectors have been placed on the market by the Holophane Company, 227 Fulton Street, New York.

High-Voltage Tantalum Lamps.

The General Electric Company is offering to the trade tantalum lamps designed for use at e.m.fs. of from 200 to 250 volts. The 200-volt lamp is rated at 50 watts and the 250-volt unit at 80 watts. It is claimed that the life of these lamps is fully as great as that of the regular 100-volt and 125-volt tantalum lamps operated at the same specific consumption of 2 watts per candle.

Telefunken Wireless Telegraph System.

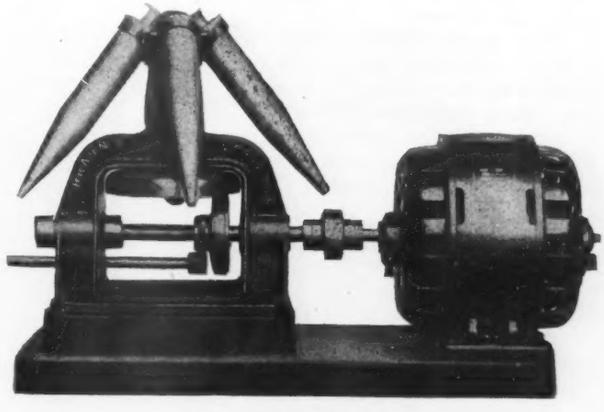
Reports from abroad indicate that excellent results are being obtained with the Telefunken Company's new "Singing" or "Quenched" or "Sounding Spark" system, as it has variously been designated, which was recently described by Count Arco in a paper before the Verband Deutscher Elektrotechniker (German Electrotechnical Society) at Cologne. During preliminary tests upon the completion of a 20-kw station at Pola, on the Adriatic—which is one of three similar stations now being erected for the Austrian Government—it was found that the signals were so strong at both the Norddeich (on the North Sea coast) and the Kopenhagen station that perfect coherer reception—i. e., signals printed on tape—was possible at both stations.

It was also possible to copy everything in Berlin with an ordinary portable set and 25-meter mast, and with another portable set of the 2-kw wagon type and a 25-meter mast, perfect communication both ways was maintained between Vienna and Pola. Still better results were obtained with an 8-kw set installed on the Austrian battleship *Erzherzog Karl*. The tests were made with the vessel at anchor in the harbor at Pola and in this case everything sent was copied at Kiel.

Very interesting results showing the immunity from atmospheric interference with this system were also obtained with three vessels of the Black Sea fleet. These vessels were equipped with 2-kw sets, and while one remained at anchor at Sebastopol the other two steamed out to sea. The transmitters of all three sets were adjusted for the same wave-length but for different tones and although atmospheric effects—always troublesome on the Black Sea—were particularly strong, perfect communication both ways was maintained up to a distance of 600 km. It was also possible to receive two messages simultaneously from the moving vessels at the station in Sebastopol, over the entire range and on one and the same receiver and detector, but with two differently adjusted telephone receivers. The fact was also noted during these tests that the signals from an old type 15-kw station near Sebastopol —which was also used—became absolutely unintelligible on board the moving vessels on account of atmospheric effects long before the effective range of the 2-kw sets had been accomplished.

Motor-Driven Centrifuge.

The motor-driven centrifuge shown herewith, which is designed for rotating a liquid at high speed in order to produce a separating force greater than gravity, consists of pivoted receptacles mounted to rotate about a vertical axis, the speed reaching about 1500 r.p.m. Under these conditions the centrifugal pull is 320 times as effective in separating the mixtures as is the force of gravity. Since, when in use the containers swing out horizontally, the centrifugal force on the material in their extreme tips is about twice that at the center of gravity of the containers. Accordingly, separations can be made with the apparatus in a very short time, while the adjustable-speed friction drive enables the tubes to be started gradually and brought up to any desired speed. The little motor shown, a ¼-hp Westinghouse, is directly connected to the friction-wheel shaft, which communicates its motion to the face wheel, giving a range from 1000 to 2000 r.p.m. The glass container tubes are surrounded by water and inclosed in an aluminum case, furnishing a cushioning surface which prevents breakage. The



MOTOR-DRIVEN CENTRIFUGE.

tubes contain 100 cu. cm and are calibrated to tenths of a cu. cm, so that the results are easily and quickly read off. The motor-driven centrifuge is of recurring use in the laboratory and is a practical necessity in the separation of heavy, thick, viscous liquids, such as crude oils, etc. The above-described centrifuge is manufactured by F. W. Braun, Los Angeles, Cal.

Meter-Testing Rheostat.

In calibrating service watt-hour meters it is the general practice to use an artificial load, and a bank of incandescent lamps is commonly employed for this purpose. The latter is far from satisfactory on account of its size and weight and is uneconomical because of the expense of lamp renewals. The meter-testing rheostat illustrated herewith, a recent product of the

FIG. 1.—METER-TESTING RHEOSTAT.

General Electric Company, is especially adapted for testing service, as it has small dimensions and weighs only 7 lb. Fig. 1 shows the rheostat complete. As may be seen from Fig. 2 a number of resistance units is supported by a sheet metal frame and connections are made to knife switches, mounted on a small terminal board. Each switch is marked with the value of the load which it controls, the steps being arranged to give loads from ½ to 15 amp in ½-amp increments. On the inner side of the terminal board are two binding posts into which the line wires are inserted and fastened by set screws. The sides

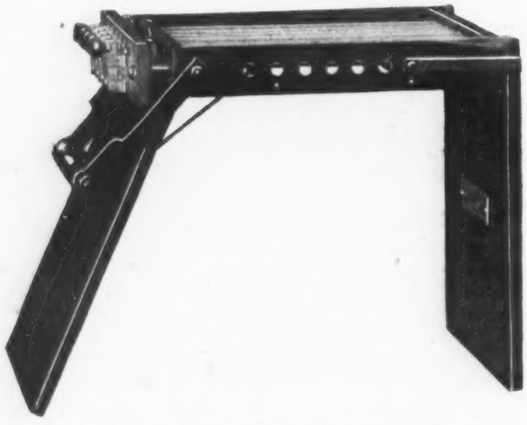


FIG. 2.—METER-TESTING RHEOSTAT READY FOR USE.

of the box are hinged and serve as supports when the rheostat is in use.

The resistance metal of the meter-testing rheostat is non-corrosive and has a low temperature coefficient. It is wound on a fireproof body and the complete unit is covered with a protecting compound.

Storage Battery in 24-Hour Service.

In 1907 the Sisseton Mill & Light Company, of Sisseton, S. D., decided that it would be distinctly advantageous to maintain a day service if it could be accomplished without a prohibitive expense. It was believed that the change would not only result in giving better service to the existing customers, but would enable the company to obtain a number of new customers who would not use electricity for lamps and motors unless a 24-hour service could be promised.

It was out of the question to give this service by operating the generating equipment, as the additional cost of fuel and labor would have been excessive. Consequently, in September, 1907, a 134-cell battery with a rating of 25 amp for eight hours was installed. The battery jars were of such a size that the rating of the battery could be increased by 40 per cent at any time by the installation of additional plates, thus providing for the natural growth of the day service. This battery has now been in service nearly two years and the Sisseton Mill & Light Company has had an opportunity of accurately determining the results that have been obtained.

The gross business has increased 25 per cent, this being attributed almost entirely to the 24-hour operation that has been made possible by the battery. The total expenses have increased only 5 per cent. The net receipts of the plant have increased by an amount equal to approximately 25 per cent of the cost of the battery. In other words, the gross return on the battery investment amounts to approximately 25 per cent, leaving an ample profit after deducting the interest and maintenance charges; the additional operating expense, due to the installation of the battery being covered by the 5 per cent increase in expenses referred to above.

The battery is of the "chloride" type manufactured by the Electric Storage Battery Company, Philadelphia.

Artistic Tungsten Fixtures.

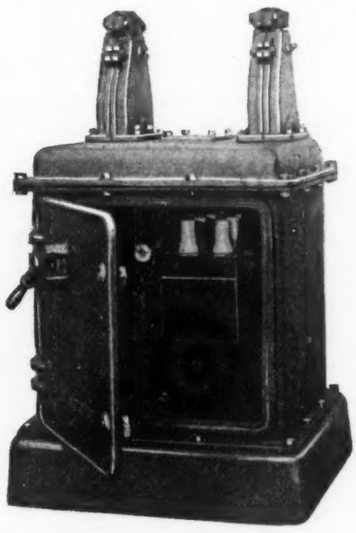
The lighting fixture illustrated herewith is one of seven designs developed by the Central Electric Company, Chicago, in conjunction with the Price-McKinlock Company, Boston, for use with Opalux reflectors and tungsten lamps. In designing the fixtures an attempt has been made to obtain correct proportions from the artistic point of view, the proper dimensions for the desired illuminating effect, and the most satisfactory

ARTISTIC TUNGSTEN FIXTURE.

arrangement from the standpoint of economy in installation. It is said that the reflectors employed not only transmit sufficient light to prevent deep shadows on the ceiling, but give a distribution free from glare. The reflecting surface is entirely on the inside of the bowl so that any dirt or dust on the outer surface has practically no effect on the efficiency of reflection.

Pillar Switchgear for Mining Work.

One of the standard mining pillars designed by the British Westinghouse Electric & Manufacturing Company, Ltd., of Manchester, England, for collieries, or for use in exposed situations generally, is shown herewith. The switches are completely enclosed in substantial cast-iron pillars, which afford



PILLAR SWITCHGEAR.

complete mechanical and fire-risk protection. A unit type of construction is employed so that the pillars may be utilized singly or in groups. In order to prevent indiscriminate handling, the pillars are rendered fool-proof by interlocking the door, isolators and oil switch in such a manner that the correct sequences must be followed in opening the device for inspection. First, the oil switch must be opened, after which the isolators can be operated and thus disconnect the oil switch terminals from the supply mains or busbars. It is said to be impossible for the door of the pillar to be opened until both these operations have been performed. The interior being accessible through the door at the front, the pillars may be placed against a wall, the cables being run to the leading-in boxes on top of the apparatus. The switchgear is suitable for use on circuits having potentials up to 3300 volts, and may be fitted with either ammeter or voltmeter, or both, together with fuses, oil-immersed switches or knife switches. The latter type of switch is used only for circuits up to 600 volts, each pillar being then fitted for two circuits.

Electricity at the World's Shoe and Leather Exposition.

At the first World's Shoe and Leather Exposition held in Cambridge, Mass., during the month of July electrical methods of illumination and power service were greatly in evidence. The fair was held in a new reinforced concrete structure specially built for permanent exposition service on the west bank of the Charles River between the Harvard and the Longfellow bridges and directly opposite the Back Bay district. The building has a seating capacity of about 20,000 persons and is one-third larger in floor area than Madison Square Garden, New York. All the machinery of the exhibitors was motor driven, and energy for both power and lighting was supplied by the Cambridge Electric Light Company's service.

The illumination of the exposition was strikingly effected by the use of several thousand tungsten lamps for interior service and by the installation of about 50 flaming-arc lamps on the exterior of the structure. The latter gave the building a brilliant appearance at night from all parts of the Back Bay and Cambridgeport. The flaming lamps were hung from poles carried for the most part on the flat roof of the exposition building, a number being used in addition to illuminate the approaches and exits together with the automobile parkway, where motor vehicles were handled to and from the fair. The roof was opened for promenading, with refreshments on sale at the corner towers, and the arcs enabled the utmost freedom of movement to be enjoyed. In the interior tungsten lamps were installed on the under sides of all the ceiling and roof trusses of the building, with a central massing of incandescents under the dome to give maximum brilliancy at the band stand. A large number of concealed lamps were installed in the showcases of the exhibitors, where an investment of $75,000 had been made in plate glass and mahogany fittings.

In the power field the most elaborate exhibit was that of the United Shoe Machinery Company, which consisted of a complete shoe manufacturing plant erected in the main auditorium and in which Goodyear welt shoes were produced by passing through all the stages between the raw material arrival and the packing in cartons for shipment. The machinery was arranged in two rows, each row being group driven by a separate motor, one being a 15-hp and the other a 10-hp Western Electric Company's induction motor. Among the machines driven in this exhibit were equipments for cutting, stamping, punching, sewing, turning, creasing, folding and otherwise manipulating the stock handled. Closely associated with the above exhibit was that of the Singer Sewing Machine Company, which was operated in part by the motors above mentioned as a separate department in the manufacturing process. A 3-hp Western Electric motor of the induction type was also installed for driving about 30 sewing machines of different types. In a gallery above eight 1/7-hp Diehl 220-volt induction motors, each direct-connected to a special sewing machine for shoe work, were installed. The compactness, simplicity and reliability of the individual drive were notably in evidence.

The Stuart-Howland Company, of Boston, had an exhibit space in which the wide range of that organization's electrical supplies was emphasized and a feature made of the Excello flaming-arc lamp. The Newman Manufacturing Company, of Cincinnati, Ohio, showed seven automatons and special moving devices for displaying shows in windows, each driven by a 1/10-hp motor. One of the most novel was an automatic "lady" electrically operated to show the effect of different types of shoes on the foot. The Narrow Fabric Company, of Reading, Pa., exhibited a shoe-lacing machine driven by a ¼-hp Westinghouse motor and the Burroughs Adding Machine Company, Detroit, Mich., showed a full line of electrically operated calculating and checking equipments.

The Puritan Manufacturing Company, Boston, showed five wax-thread sewing machines driven by individual motors of from ⅛ to ¼ hp each and four marking machines driven by 1/10-hp Emerson motors. Thos. W. Gardiner, Lynn, displayed a last-making machine driven by a 3-hp General Electric motor. The Boston Machine Works Company exhibited a cementer, two folders, vamp-folding machine, beader, finisher, top cutter and evener driven in group by a 5-hp motor. The G. W. Baker Machine Company, of Wilmington, Del., showed two roller-staking machines driven together by a 7½-hp motor of Western Electric make. J. E. Nightingale, of Danvers, Mass., showed two measuring machines driven by a Holtzer-Cabot motor of ¼ hp and the Peabody Leather Machinery Company exhibited a shaving machine driven by a 5-hp motor and a measuring machine operated by a ½-hp motor.

The Western Electric Company, Chicago, displayed a full line of intercommunicating telephone equipment for factory service, induction motors up to 7½ hp, direct-connected exhaust and office fan motors, D & W inclosed fuses up to 12-kw capacity, inclosed arc lamps and the Victor flaming arc. A recent feature of the telephone equipment is the use of individual buttons for ringing and listening in place of the separate buttons found in the usual Bell office sets. The company was represented by Messrs. Rounsville, Twitchell, Robinson, Raftery, Damrell and Tiffany. The New England Telephone & Telegraph Company installed special circuits and service for the exposition.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

There has been a notable accession of prosperity in the commercial world since the final settlement of the tariff matter. This has brought out a flood of orders, specifications for which have long been determined upon but which have been held up until the new business basis was finally agreed upon. Retailers have come into market in greater numbers, and their orders bid fair to be unusually liberal. This is especially anticipated because the summer clearance sales have lasted longer and been more generally successful than was expected, clearing the shelves to low-water mark. Another thing which has cheered all business sections is the wonderful report from the growing crops. There is now little doubt that the return to the farmers in money will be the greatest ever known in the history of the country. Even in the South, where the cotton crop promises to be considerably short of original expectations, the rapid advance in the selling price of the staple will more than make up the defficiency in volume. Already there has been a vigorous movement of crops in the West, and there have been healthy shipments of coal, lumber, iron and steel in the Eastern territory. These things are swelling the earnings of the railroads, and will soon make it necessary for them to go into the equipment market with valuable orders. In the steel and iron industries there is a further expansion of production, and prices are constantly strengthening. It is claimed that in the advance movement the independents are leading the United States Steel Corporation, although everywhere rates are much better than they were a few weeks ago. New business in steel rails is not large, but many heavy orders are pending. Structural material continues to be in excellent demand, and there have been many orders for steel cars. One of the features of particular note is the extremely sanguine tone taken by every leader of finance or commerce. Frank A. Vanderlip, president of the National City Bank of New York, voiced the common sentiment when he said, upon his return from a trip through the West last week: "I am a bull on business. In my opinion, we are at the beginning of a long period of most profitable commercial activity. The only check to it can be some most unexpected and unlooked-for occurrence. Of that there is not at the present the faintest indication. Not a cloud is to be seen on the financial horizon, nor is there even the semblance of one." According to *Bradstreet's* report the failures for July were 974, about the same number as in June, but 17.7 per cent less than in July, 1908. The liabilities for the month were $8,299,169, a decrease of 16 per cent from June and of 63 per cent from July a year ago. Failures for the week ending with Aug. 5 were 184, against 223 last week, 205 in the like week of 1908, 157 in 1907, 137 in 1906 and 166 in 1905.

THE COPPER MARKET.

The past week has been one of considerable inaction in the copper market. There has been very little speculative demand from London and the takings of the domestic consumers has apparently been very light. At the time this report is closed the July figures of the Copper Producers' Association has not been made public, but the market was full of interesting rumors foreshadowing the statement. These for the most part indicated that there had been a decrease in producers stocks during the month of something like 44,000,000 lb. If the figures bear out this report it indicates that both at home and abroad the speculators and consumers must have stocked up to a far greater extent than had been generally believed. It is known that during the month of July the stocks in foreign warehouses increased by more than 20,000,000 lb. and it is certain that further piling up has continued in August. In the meantime the betterment of the copper situation by such a decrease in producers stocks is more technical than real. There is every indication that the actual melting of copper is very little greater than it was a few months ago, while the production is at the record mark. The decrease in the producers surplus therefore can mean little beyond a shifting of stocks—a transfer from the smelters' yards to storage warehouses and manufacturers' sheds. Trading in copper on the Metal Exchange has been dull and the tone of the market has been weaker for spot transactions with relatively higher prices for future shipments. Imports continue to be large and exports for the month up to and including Aug. 9 were 6,826 tons. The daily call Aug. 9 at 12:30 o'clock on the Metal Exchange for standard copper was as follows:

	Bid.	Asked.	Settling price.
Spot	12.65	12.80	.....
August	12.60	12.85	12.72½
September	12.65½	12.95	12.80
October	12.65	13.00	12.82½
November	12.75	13.00	12.87½
December	12.75	13.00	12.87½

The London prices on the same date were as follows:

	Opening. £ s d	Close. £ s d
Standard copper, spot	58 13 9	58 15 0
Standard copper, futures	59 12 6	59 13 9
Market	Firm.	Steady.
Sales of spot		400 tons
Sales of futures		900 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	54 10 0
London, best selected	67 15 0	59 0 0

ELECTRIFICATION OF THE NEW YORK CENTRAL.—In the expense budget of the New York Central & Hudson River Railroad for the year which ends June 30, 1910, there appeared an item of $8,477,682, set aside for the electrification of suburban lines and for a New York terminal. This amount of money indicated rather more electrification than was contemplated. A large portion of this money will be spent in the perfection of the New York terminal; some of it will be spent in adding extra tracks within the electric zone, but only a comparatively small part of it will be spent for electrification proper. One of the engineers of the New York Central, in outlining the plans of the railway for the coming year, said that it is contemplated that the electrical zone will be extended on the Harlem division from Mount Vernon to North White Plains, a distance of about 10 miles. This will be equipped with the third rail, and all of the standard electrical appliances that are used in the other electrical zones of the New York Central. Curves and also grade-crossings will be eliminated, and the road will be put in first-class shape for express service. Two substations are to be constructed, one at Tuckahoe, and another, exactly similar, at White Plains. These substations will contain three 1000-kw rotary converters, similar in design to those that are now in service in the substations of the New York Central. The transmission will be on aerial lines on steel towers, like the other lines of the New York Central, and the entire equipment will be standardized according to the New York Central's ideas. Circuit-breaker houses of the usual form will be established about every two miles of this road. The New York Central contemplates making four tracks on its Hudson division all the way to Yonkers. At the present time there are four tracks to Spuyten Duyvil, but only two to Yonkers.

AUTOMATIC ARMATURE BINDING MACHINES WANTED.—Julius West, 5 Landhausstrasse, Degerloch-Stuttgart, Germany, writes that he desires to receive from manufacturers prices of automatic machines for winding the armatures of small motors.

ELECTRICAL DEVELOPMENT IN URUGUAY.—Consul Frederic W. Goding, of Montevideo, reports that it is under contemplation to electrify the horse street railway in that city and to erect electric cranes and install an electric light service along the wharves.

CHINESE TELEPHONE ORDER FOR WESTERN ELECTRIC.—The export department of the Western Electric Company received last week, from Pekin, China, a cablegram stating that a contract with the Chinese Government to supply a complete common battery telephone plant for the city of Pekin had been signed. The Chinese Government, through the president of the Board of Communications, had ratified the sale, which came as a result of negotiations of a year's standing. This order was secured after strenuous competition, in which the largest telephone manufacturers of the world figured. China is absolutely a new field for telephones, and one giving great promise for future development. Heretofore there have been telephones in only a few of the cities of China, and these are largely in the foreign quarters, which were served by small, out-of-date systems. The two switchboards sold by the Western Electric Company to the Government are the first common battery boards in the entire empire, yet China has an estimated population of over 400,000,000. Our own country, with a population only one-fifth as large, has more than 1000 telephone exchanges larger than the two intended for Pekin, besides fully 15,000 smaller ones in towns. Though only two exchanges so far have been ordered, this is considered as merely the beginning of a system that will eventually be fully developed throughout China. The Board of Communication not long ago formed what was known as the International Chinese Telephone Administration. Last fall F. M. Dresing, foreign advisor of this body, while on an American tour visited the Western Electric Company, and made known the desire of the Chinese Government to buy telephone equipment. Chinese commissioners visited this country, inspected the telephone plants of the large cities and were shown through the shops of the large telephone manufacturers. The Western Electric Company then sent a special emissary to Pekin. The order amounts to about $150,000, and covers a complete plant of modern type, including several hundred thousand feet of lead-covered aerial and underground cable. The contract calls for complete delivery at Tientsin by Feb. 3, 1910. The work of installation will be done under the supervision of one of the Western Electric's engineers.

WESTINGHOUSE STORAGE BATTERY COMPANY.—The Westinghouse Storage Battery Company, which, as announced in our issue of July 15, was incorporated in Albany with a capitalization of $1,750,000, which included $250,000 6 per cent preferred stock, has acquired all of the plants, equipment, patents and business of the storage battery department of the Westinghouse Machine Company and all of the property of the General Storage Battery Company. The equipment at the plant of the Westinghouse Machine Company at East Pittsburgh will be moved to Boonton, N. J., and installed in the works formerly occupied by the General Storage Battery Company at that place, thus giving the new company the greatly increased manufacturing facilities so essential to prompt deliveries. The Westinghouse Storage Battery Company will manufacture both the Westinghouse and Bijur types of battery for such service as each has been shown to be adapted. The new company's staff of engineers is composed of men of long experience, and the laboratories for testing raw materials and finished product are well equipped. The officers of the new company are: H. H. Westinghouse, president; H. T. Herr, vice-president; S. B. Dusinberre, vice-president and general manager; T. L. Brown, treasurer, and T. S. Grubbs, secretary. The general offices of the company will be at Boonton, N. J., with sales offices in the principal cities of the country. The New York office will be located at 165 Broadway.

REORGANIZATION OF CABLE CODES.—The American Cable Companies are determined that there shall be a revision of the codes now in use by commercial houses which will at least restrict the messages to ordinary English words. "The regulations for all cable messages," said George Clapperton, of the Commercial Cable Companies, "are fixed by the International Telegraph Convention. This was established in 1875, and, as you can readily understand that, considering the political condition of Europe, there must be some international agreement to insure the safe passage of messages, say from Paris to St. Petersburg via Berlin. The United States, standing outside of all these diplomatic complications, has had no need to join such a conference, but it is none the less forced to abide by its regulations. Our cables, for example, land in England, and we are obliged to take only such messages as the British Government will forward. In America the use of codes has enormously increased the difficulties of the cable companies. Some of the most impossible words have appeared, and these lead to constant mistakes. Big importing and international houses have spent much money on these codes, and it may produce some hardship to have them changed. The cable company, however, must protect itself and there will be a general simplification."

ELECTRIC PUMPING IN PANAMA.—Authority has been granted for the purchase of a pumping plant to lift water from the reservoir in process of construction near Gatun, to the large tank on the hill in that village. The plant will consist of two three-stage centrifugal pumps directly connected to a three-phase 440-volt induction motor. Each pump will have a capacity of 1400 gal. a minute with a suction lift of 12 ft., and will deliver against a head of 300 ft. The distance from the pumps to the water tank at Gatun will be about 6800 ft., and delivery will be made through a 12-in. main. There will be two suction connections, one with the filtered water sump, and one direct with the reservoir. It is desired to have the pumps operated automatically by a float valve in the tank. A 5-ton hand-operated crane will be installed at the station to assist in making repairs.

ALLIS-CHALMERS COMPANY DOING GOOD BUSINESS.—The Allis-Chalmers Company reports that all of its plants are busy, and that orders are very satisfactory. Among the sales of large electrical apparatus which have recently been made are: from the Merchants' Heat & Light Company, of Indianapolis, for two 1000-kw synchronous motor-generator direct-current sets, and one 200-kw shunt-wound balancing set, consisting of two 125-volt machines on a common cast-iron base; Delaware, Lackawanna & Western Railroad, Hampton power plant, Scranton, Pa., one 1500-kva transformer, and San Francisco Gas & Electric Company, San Francisco, Cal., two 1000-kw synchronous motor-generator sets. Numerous other orders have also been recently booked for transformers and for small apparatus.

HYDRO-ELECTRIC DEVELOPMENT ON THE CHIPPEWA RIVER.—The Chippewa River Power Company, of Port Huron, Mich., has secured lands on the Chippewa River and also most of the necessary township rights for transmission lines and franchises in Mount Pleasant, and expects to obtain additional franchises in Alma, Ithica, Midland and Bay City. These cities will furnish a market for 7500 hp, to develop which the company will erect five dams on the Chippewa River. From the fall in the distance the company expects to develop 125 ft. Wilbur F. Davidson, whose son is president of the Consolidated Lighting Company of Montpelier, Vt., is interested in the project.

COOPER HEWITT ELECTRIC COMPANY.—The Cooper Hewitt Electric Company reports that its business during the month of July has been the best in three years. During that month the Pittsburgh agency alone took contracts for 400 Cooper Hewitt lamps. One hundred of them were placed in the factory of the Canton Stamping & Enameling Company, of Canton, Ohio; an equal number with the Berger Manufacturing Company of the same place, and 90 with the Crosby Company, of Buffalo. The Cooper Hewitt lamp, it is claimed, is becoming constantly more popular with large factory owners and the demand for lamps has never been greater than at present.

DOHERTY IN CONTROL OF ENTIRE JOPLIN FIELD.—At a meeting of the stockholders of the Spring River Power Company, of Joplin, Mo., held recently, the interests of which H. L. Doherty & Company, of New York, are representatives elected nine out of the 15 directors. At a meeting held subsequently the directors elected Mr. Doherty as president of the company. The acquirement of this property practically gives Mr. Doherty control of the Joplin mining district. Interests identified with his firm already dominate the Consolidated Light, Power & Ice Company and also the Missouri Zinc Fields Company.

ELECTRICAL PLANT FOR MANUFACTURE OF STEEL PRODUCTS IN MEXICO.—According to the *Mexican Herald*, a company, to be known as the Mexico Steel & Chemical Company, has been organized, with a capital of about $500,000. The purpose is to manufacture steel and chemical products by means of electricity. A plant will soon be in course of construction. It is intended to manufacture rails, steel castings, shoes and dies for mining mills, and calcium carbide.

WESTINGHOUSE COMPANY MAKES AUTOMOBILE ENGINES.—The Westinghouse Machine Company has added a department to its works at East Pittsburgh for the manufacture of gasoline motors for automobiles. The company has been making preparations to take this step for some time. An order has been secured for 1000 motors from one of the largest automobile manufacturers in this country, and negotiations are pending with other automobile firms which will bring additional orders for about 50,000 of these motors to the company's works within the near future. During the business depression of the last year the company found itself greatly handicapped because, being a manufacturer of only large prime movers, its business was practically at a standstill as the demand for that class of machinery was very small. This condition suggested to the management the idea of entering into the construction of other machinery, and the addition of the automobile motor department has been the result. With the facilities in the East Pittsburgh shops, and the company's extensive experience in the making of gas engines, the works are able to meet the requirements of any of the automobile manufacturers and a large business is expected to be done in this line. It is stated that in the meantime the orders for steam turbines and gas engines have continued to come in constantly in increasing quantities, and the business of the company during July will cause it to be recorded as another heavy month. There are also orders for 75,000 hp Le Blanc condensers in the factory, besides a number of gas engines of various sizes.

WESTINGHOUSE SHOPS KEPT BUSY.—The July business of the Westinghouse Electric & Manufacturing Company was the largest done by the company in a single month during the last two years, the amount representing approximately $3,000,000. All departments at the East Pittsburgh works show considerably increased activity, and it has been necessary to add to the productive force everywhere. The company recently received an order for electric railway material, which for various reasons is particularly noteworthy. This order came from the Chicago Railways Company, and called for the quadruple equipment of motors for 350 cars, making a total of 1,400 railway motors. This is the first time Westinghouse motors have been ordered for the surface lines of the Chicago railways. With this order for motors and the work already on hand in the railway motor department, that section of the factory will be kept very busy for the next six months.

ELECTRICAL SUPPLIES FOR NAVY DEPARTMENT.—The Navy Department in Washington will open bids, on Aug. 17, for 15,000 ft. of cable. On Aug. 24 bids will be opened for cable for portable lamps—cord, lamps, conductors, carbon and other electrical supplies; two electrical hoists; dry batteries; graphite brushes; 1500 arc lamp carbons; 4000 ft. ebonite rod; fans, armatures and desk lamps, and two motors. On Aug. 31 bids will be received for two fire alarm annunciators, 8000 carbons, and for tape fuses and miscellaneous supplies.

WESTINGHOUSE TURBO-GENERATOR FOR SOUTHERN COTTON MILL.—A 2500-kw Westinghouse steam turbo-alternator has been ordered for furnishing service to the Erwin Cotton Mills, at West Durham, N. C. The steam element operates at 175-lb. pressure, and exhausts into a 27-in. vacuum. The energy distribution will be made with three-phase, 60-cycle current at 600 volts. This property is the largest among the cotton-mill interests of the Dukes, of the American Tobacco Company.

AMERICAN ELECTRICAL SIGNS IN EUROPE.—A dealer in electrical apparatus informs an American consul in a European city that he would like to communicate with manufacturers of electrical signs desirous of selling their patent rights in that country. The file number of the inquiry is 3700.

GENERAL ELECTRIC MICA MINES.—The General Electric Company's mica mines at Loughboro, Canada, has an output sufficient to keep engaged 150 girls in the company's trimming factory at Ottawa. The company has also trimming factories at Carleton Place, Smith's Falls, Ontario.

CARTHAGE (N. Y.) WATER POWER COMPANY.—The Carthage (N.Y.) Water Power Company, which recently constructed a hydro-electric plant on the Black River, has recently purchased two 1000-kw generators from the General Electric Company.

THE ILLINOIS TRACTION COMPANY, with headquarters at Peoria, Ill., has ordered 50 40-ton coal cars from the American Car & Foundry Company, for use on its extensive interurban railway system. These new coal cars will supplement about 400 of the same type now in use.

TRAMWAY CONSTRUCTION IN UNITED KINGDOM.—An American Consul writes that a power company in the United Kingdom has determined on the construction of 12 miles of single track electric tramways between towns of importance. The file number of the inquiry is 3715.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market continued on its upward course during the past week, with only slight interruptions. New high records were made almost every day, and the temporary set-backs attracted little attention, being due almost entirely to the profit taking of small traders. Both Union Pacific and Steel common, which were practically the leaders of the market, reached new high figures. The latter on Aug. 9 sold up to 78⅛. Union Pacific has been up to 205⅜, and the volume of sales continues to be very large. Reading continues to be phenomenally active and sold as high as 165¼. There seems to be no check to the feeling of optimism that prevails in financial circles. While business has not recovered to the high-water mark of 1907,

NEW YORK.

	Aug. 2.	Aug. 9.	Shares sold.		Aug. 2.	Aug. 9.	Shares sold.
All.-Ch.	16¼	15¾	8,300	Int.-Met., pfd..	48	46½	46,840
All.-Ch., pfd..	57	56¼	11,100	Mackay Cos...	84⅛	83½	400
Amal. Cop....	84¾	85⅜	121,969	Mackay Cos.,p.	74¾	74¾*	230
Am. D. T.....	30*	30*	——	Man. Elev.....	144½	144⅜*	200
Am. Loc.....	67¼	68¼	43,830	Met. St. Ry...	20*	24*	300
Am. Loc., pfd.	120¾	120½	1,100	N.Y. & N.J.Tel	142	142½*	350
Am. Tel.&Cbl..	84*	76*	119	Steel, com....	74¾	77½	558,475
Am. T. & T...	143¼	142½	25,573	Steel, pfd.....	128½	126¾	37,905
B. R. T.....	80½	80½	31,240	W. U. T.....	76	75½	2,270
Gen. Elec.....	170	171¾	9,175	West'h, com..	86	88¾	32,100
Int.-Met., com.	15½	15½	19,000	West'h, pfd...	124½	124½*	100

PHILADELPHIA.

	Aug. 2.	Aug. 9.	Shares sold.		Aug. 2.	Aug. 9.	Shares sold.
Am. Rys.....	46	45⅞	——	Phila. Elec....	12⅜	12⅜	——
Elec. Co. of A.	12¼	12⅜	——	Phila. R. T...	32⅛	31¼	——
Elec. St. B'ty..	62	62	——	Phila. Trac...	90⅞	91	——
E. S. B'ty,pfd.	49*	49*	——	Union Trac...	55⅞	55¼	——

CHICAGO.

	Aug. 2.	Aug. 9.	Shares sold.		Aug. 2.	Aug. 9.	Shares sold.
Chi. City Ry...	180*	180*	——	Chi. Tel. Co..	134	134	——
Chi. Rs.,Ser.1.	119½*	119½*	——	Met. El., com.	16*	16*	——
Chi. Rs.,Ser.2.	39*	37⅞*	——	Met. El., pfd..	47¼*	49	——
Com. Edison...	120	120	——	Nat'l Carbon..	92½	94*	——
Chi. Sub'ws...	19½	23½	——	Nat'l C., pfd..	119*	119*	——

BOSTON.

	Aug. 2.	Aug. 9.	Shares sold.		Aug. 2.	Aug. 9.	Shares sold.
Am. T. & T...	143¼	142¾	——	Mex. Tel.....	2¾	2¾*	——
Cum. Tel.....	145½*	145*	——	Mex. Tel., pfd.	6*	6¼*	——
Edison E. Ill..	254*	254	——	N. E. Tel....	134	137¾	——
Gen. Elec.....	170	172	——	W. T. & T....	12	11¼	——
Mass. E. Ry..	12⅜	13	——	W. T. & T., p.	90	89	——
Mass. E. R., p.	72	74⅛	——				

*Last price quoted.
Shares sold are for week Aug. 2 to Aug. 7.

stocks are much more buoyant and for that matter, in most instances, selling at higher prices than they were during the period of greatest commercial prosperity. This condition has led many conservative observers to feel that the market is entitled to a substantial reaction and that speculation upon the present level of prices is not without danger. There are many others, however, who believe that the market at the present time is more completely in the hands of powerful financial interests than at any time in its history; they believe that these great leaders do not intend to permit a serious slump and that under ordinary circumstances, they will be able to prevent it. Of course under the present condition of more or less inflated prices, any disaster that seriously affected commercial interests might bring about a sharp reaction. Every outside influence is in favor of continued high prices. The crop reports indicate that the farmers will receive more money for their products this year than ever before. This means money for the retailers, for the manufacturers and for the railroads. It means that the big transcontinental lines must soon go into the equipment market for extensive renewals of their depleted rolling stocks. All of these things contribute to the general belief that high prices are here to stay. Of course the immediate upward

movement that occurred during the past week is largely attributable to the settlement of the new tariff schedules. These form the basis upon which business must be done and it is well known that many conservative corporations have been unwilling to expand until the new rates were entirely settled. There continues to be a very healthy demand for bonds and many concerns have taken advantage of this to readjust their finances. Although gold shipments continue to be fairly liberal, especially to Argentina, there seems to be no indication of any contraction in the money market. Rates are still cheap and cash is plentiful. Quotations Aug. 9 were: call, 1⅞ @ 2½ per cent; 90 days, 3 per cent. The quotations in the table are those of the close, Aug. 9.

DIVIDENDS.

American Smelters Securities Company, quarterly, preferred A, 1½ per cent; preferred B, 1¼ per cent, both payable Sept. 1.

American Telegraph & Cable Company, quarterly, 1¼ per cent, payable Sept. 1.

Butte Electric & Power Company, quarterly, preferred, 1¼ per cent, payable Nov. 1; quarterly, common, 1½ per cent, payable Oct. 1.

Kings County Electric Light & Power Company, quarterly, 2 per cent, payable Sept. 1.

Philadelphia Company, preferred, semi-annual, 2½ per cent, payable Sept. 1.

ENGINEERING SECURITIES CORPORATION is the new name of the Engineering & Electrical Securities Corporation, of 43 Exchange Place, New York City, of which J. G. White is president; F. H. Reed, vice-president; R. B. Marchant, secretary and treasurer; T. C. Gillespie, assistant secretary and treasurer, and R. T. Lozier, special representative. The company has in reality been in existence some years, owning securities and taking part occasionally in underwritings or other issues of securities. It deals in high-grade securities of engineering enterprises and aims rather to distribute them through established bankers than to build up a competitive organization for selling securities at retail. The company is now enlarging its sphere of operations and broadening its area of contact and influence.

PUBLIC SERVICE CORPORATION BONDS SOLD.—V. Drexel & Company and J. P. Morgan & Company have purchased $8,000,000 Public Service Corporation, of New Jersey, first mortgage 5 per cent 50-year gold bonds. This is part of the $50,000,000 issue dated May 1, 1908, of which $5,500,000 are outstanding. The proceeds of this issue are to be used to take up outstanding notes and for improvements. There are $7,250,000 5 per cent collateral trust notes, dated Nov. 1, 1904, and due Nov. 1, 1909. Also $6,250,000 5 per cent convertible 5 per cent notes due Nov. 1, 1909, convertible into stock at the option of the holders.

ALBANY & HUDSON REORGANIZATION PLANS.—The reorganization plan proposed for the Albany & Hudson Railroad Company is meeting with strenuous opposition from many of the bondholders. The plan proposes that the owners of the $1,850,000 first mortgage 5 per cent bonds shall exchange these for an equal amount of 5 per cent non-cumulative preferred stock in the new company. This does not seem promising to the stockholders. The new company is to have $1,375,000 of common stock, $2,100,000 of preferred and an issue of $1,500,000 of new 5 per cent bonds.

CONSOLIDATION OF INTERESTS AT CINCINNATI.—A deal has just been completed at Cincinnati through which a syndicate representing the Columbia Gas & Electric Company has purchased the outstanding stock of the Union Gas & Electric Company. Both the preferred and common stock were bought and the Columbia Gas & Electric interests will practically control the entire issue of stock of the amalgamated companies. The negotiations were completed through A. B. Leach, George W. Young and Oscar Gubleman, of New York, as representatives of the syndicate.

SECOND AVENUE RAILROAD CASE.—Judge Lacombe, of the United States Circuit Court, has decided that the custody of the Second Avenue Railroad Company, which is now in the hands of a receiver, properly belongs to the State courts, and not to the United States Court. This decision is based upon the fact that there does not appear to be any stockholders of importance outside of the jurisdiction of the New York courts. The transferring of this case to the State courts will put an entirely different aspect upon the litigation, which it is intended will result in reorganization.

INTERNATIONAL STEAM PUMP COMPANY.—At a special meeting of the stockholders of the International Steam Pump Company, held Aug. 5, action was postponed until Aug. 12 on the proposition as to whether or not the company should authorize an issue of $12,000,000 5 per cent bonds. It is understood that about $8,000,000 of these bonds have already been negotiated for, and that they will be taken by William Solomon & Company, while the balance will be retained in the treasury to meet the requirements of future extensions.

WILLIMANTIC LIGHTING & RAILWAY.—The Rockville-Willimantic (Conn.) Lighting Company, which has taken over all the charter rights of the Willimantic & Stafford Springs Street Railway Company, has elected Walter Learned, of New London president. The company has issued $400,000 of stock, $200,000 being 6 per cent cumulative preferred and $200,000 common shares. It has authority to issue $400,000 preferred stock and $300,000 common.

LA FRANCE COPPER COMPANY.—The stockholders of the La France Copper Company have elected a new board of directors, as follows: W. A. Kidney, R. A. Carnochan, David Gilbert, E. M. Brennan, of Butte, and John T. Williams, of New York. Mr. Williams is an employee of the United Copper Company. It is understood that Mr. Kidney, who is now general manager of the company, will be elected president, to succeed R. S. Walker.

NEW ENGLAND TELEPHONE COMPANY.—The New England Telephone Company for the first six months of the current year has shown an increase in gross earnings of more than 11 per cent compared with the same period of last year. Net profits have been showing up even better, and the increase in the balance for dividends amounted to 23 per cent. The company has planned to spend $2,700,000 for new construction and $3,500,000 for maintenance, in 1909.

UNITED RAILROADS OF SAN FRANCISCO.—The June report for the United Railroads of San Francisco and for the six months which ended June 30 are very encouraging. The gross earnings for the six months are $3,568,905, which is an increase of $227,452 over 1908. It is claimed that the labor troubles which existed earlier in the spring did something to reduce the totals in this report of earnings.

SAN JUAN WATER & POWER COMPANY.—The Animas Power & Water Company, of Silverton, Colo., has been reorganized under the name of the San Juan Water & Power Company. The company still operates on Animas River, at Tacoma, Colo., a station which develops 4500 kw, with distribution lines reaching Silverton and the mining district adjacent.

DURANGO GAS & ELECTRIC COMPANY.—The Standard Light, Power & Water Company has sold its entire property to the Durango Gas & Electric Company, an organization which is building a transmission line from Durango (Colo.) to the power plant of the San Juan Water & Power Company at Tacoma, Colo.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Albany & Hudson Railroad Company:					
Year ended June 30, 1909	$365,514	$272,301	$93,213	$114,139	$20,926
Year ended June 30, 1908	345,267	232,591	112,676	114,203	1,527
American Gas & Electric Company:					
Quarter ended June 30, 1909	170,844	.....	27,028	26,176	852
Quarter ended June 30, 1908	139,301	.....	29,123	26,175	2,948
Birmingham Railway, Light & Power Company:					
June, 1909	175,189	100,757	74,423	.....	.....
June, 1908	193,767	107,148	86,619	.....	.....
Nashville Railway & Light Company:					
June, 1909	143,644	67,368	76,276	.....	.....
June, 1908	130,191	61,606	68,585	.....	.....
Philadelphia Company:					
Year ended June 30, 1909	8,952,383	4,751,634	4,200,749	.....	.....
Year ended June 30, 1908	8,620,949	5,062,544	3,558,405	.....	.....

GENERAL NEWS

Construction News.

BIRMINGHAM, ALA.—W. J. Cameron, F. Y. Anderson, George C. Kelly and associates have applied to the City Council for a 30-year franchise to construct an electric railway on certain streets in Birmingham and to use the tracks of the Birmingham Railway, Light & Power Company.

RUSSELLVILLE, ALA.—The City Council has granted a franchise to Thornton & Ames, of Birmingham, Ala., to construct an electric-light plant and water-works system in Russellville.

TROY, ALA.—W. R. White and associates have been granted a franchise by the City Council to construct a street railway in Troy.

ROGERS, ARK.—Bids will be received by the Haefele Lamp Company, of Rogers, Ark., until Sept. 1, for equipment to be installed in its new plant for the manufacture of the Haefele electric lamp, which will include stamping machines, drilling machines, tinners' tools, etc. The machinery will be equipped for electric motor drive. R. S. Willis is president and J. E. Felker treasurer.

BISHOP, CAL.—Benjamin H. Yandell has applied to the Board of County Supervisors for a franchise to construct an electric transmission line in Inyo County to supply electricity for lamps and motors.

BODIE, CAL.—The Walker River Electric Power Company is reported to have secured from J. P. Conway, of Sweetwater, Nev., deeds to his water rights on the East Walker River and certain lands adjacent. It is said that the company will erect a power plant at a cost of $750,000 to supply electricity to mines at Sweetwater, east to Lucky Boy and Hawthorne, west to Aurora and Bodie, and north to Masonic. The East Walker River, from which the power will be generated, has a minimum flow of 6000 cu. in. per second.

FRESNO, CAL.—The San Joaquin Light & Power Company has authorized an expenditure of $500,000 on its plant in the mountains of Fresno County. The work will include the construction of a large dam in Crane Valley, work on which will begin at once. A. G. Wishon is manager.

GLENDALE, CAL.—The Trustees are considering the question of purchasing the entire electric light system owned by L. C. Brand within the city limits of Glendale for $25,000. The city recently voted to erect a municipal electric plant at a cost of $60,000.

LOS ANGELES, CAL.—An election will soon be held to vote on the proposition to establish a lighting district, the cost of which is to be maintained by an assessment against property owners of the district.

MARE ISLAND, CAL.—Sealed proposals will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 11 for the construction of a central-power station at the United States Navy Yard, Mare Island, Cal. Plans and specifications can be obtained on application to the above bureau or to the commandant of the navy yard named. R. C. Hollyday is chief of bureau.

MERIDIAN, CAL.—It is reported that the Board of Trustees has decided to enter into a contract with the Pacific Gas & Electric Company to furnish electricity to operate the pumping plant, which has been operated by a gasoline engine. The company will extend its transmission line from Marysville to furnish the service. It is said that E. A. Forbes, of Marysville, will use electrical power to irrigate his ranch north of the town.

MODENA, CAL.—Plans for the construction of the power plant for the Gold Springs Mining & Power Company have been approved. It is said that work on construction of the plant will commence at once.

OAKLAND, CAL.—The City Council has authorized the city clerk to advertise for bids for the sale of the franchise applied for by the Great Western Power Company.

REDDING, CAL.—The Sacramento Valley Power Company has purchased extensive water rights on North Battle Creek, in Shasta County, and proposes to develop the water power and to double the present output of its plant.

SAN DIEGO, CAL.—G. W. Purcell has applied to the City Council for a franchise to operate an electric railway in San Diego. The proposed railway is to connect San Diego, La Mesa, El Cajon, Bostonia, Lakeside, Poway and Escondido. The cost of the road is estimated at about $2,000,000.

TULARE, CAL.—The Mt. Whitney Power Company has purchased a site on Kern Street, on which it will erect a new substation in the near future for the purpose of supplying electricity for lamps and motors in this city.

BOULDER, COL.—The Eastern Colorado Power Company is planning to enlarge its irrigation project, six miles northeast of this city. It is proposed to raise both dams 5 ft., giving the two reservoirs a combined capacity of 744,052,000 cu. ft. of water. The cost of the work is estimated at $250,000.

COLORADO SPRINGS, COLO.—The Royal Gorge Power Company is reported to be contemplating the development of two hydro-electric power projects of approximately 20,000 hp each.

DE BEQUE, COL.—E. A. Swenson, of Colorado Springs, is reported to be interested in the construction of a water-power plant on the Grand River.

FORT LUPTON, COL.—The Lupton Utility Company, headed by D. H. Rich, who is also connected with the Denver Consolidated Engineering Company, is contemplating the erection of a combination water works, light and power and ice plant in the town of Fort Lupton within the next seven months. The town has a population of about 1,500. The plants include water mains, fire pressures, pumps, water tower for ordinary domestic uses, centrifugal pumps being used, driven by 2000-volt motor. The ice machine will also be driven by an induction motor. The generator will be direct connected to compound engine, and will have a rating of 75 kw. Franchises have been granted, and construction work will begin at once.

GRAND JUNCTION, COL.—The Grand Junction Electric, Gas & Manufacturing Company is considering plans for increasing the output of its generating plant.

HOLLY, COL.—The town of Holly has just installed a combination electric light and water works plant, utilizing a rotary pump driven by electric motor for the deep well. The street lighting system will include 25 arc lamps. Burns & McDonald, of Kansas City, Mo., are the engineers.

HOLYOKE, COL.—The town of Holyoke is installing a municipal electric light plant.

MANITOU, COL.—The Manitou & Pike's Peak Railway Company, which operates a cog railroad up Pike's Peak, is contemplating the installation of a third-rail system at a cost of about $750,000. The railway will be widened the entire distance and will use cogs, as on the old system. C. W. Sells, of Manitou, is president and manager.

RIFLE, COL.—The contract for the construction of the power plant for the Rifle Light, Heat & Power Company was awarded to Charles Fravert. The initial development will be 250 hp. E. McLearn, C. L. Todd, W. M. Maley, Dr. W. L. LeRossignol and others are interested in the enterprise. The company is capitalized at $50,000.

BRISTOL, CONN.—Plans are being made by Joseph McCabe, the contractor in charge of the tunnel work west of Bristol, to install an electric generating plant at the tunnel just over the Bristol line to furnish electricity for lamps and for power to carry on the tunnel work.

MERIDEN, CONN.—Francis Atwater, president of the Meriden, Middletown & Guilford Railway Company, has been granted a franchise by the Board of Selectmen to construct an electric railway over the Middletown Road from the tracks of the Connecticut Company to the town limit.

NEW HAVEN, CONN.—Bids will be received by the Boards of Fire and Police Commissioners until Aug. 17 for furnishing the City of New Haven with the following: Nine hundred ft., more or less, 75-wire cable; 1800 ft., more or less, 25-wire cable; wires to be No. 14 B. & S. gage, pure soft drawn copper thoroughly and evenly tinned. Conductors to be insulated to 5-32 in. diameter with a compound containing not less than 20 per cent pure Para rubber. S. J. Metzger is secretary Board of Fire Commissioners, and A. V. Phillips clerk Board of Police Commissioners.

TAFTVILLE, CONN.—Arrangements are being made by the Ponemah Mills Company for a large addition to its plant at Taftville, which will include the erection of a weave shed 670 x 200 ft., one-story high, with basement. The machinery in the new addition will be operated by electricity, which will be furnished by four 250-hp motors.

WILLIMANTIC, CONN.—The Rockville-Willimantic Lighting Company, recently organized, is reported to have made arrangements to secure electricity from the hydro-electric plant of the Uncas Power Company, located 10 miles above Norwich on a tributary of the Thames River, which will save the company about $12,000 on the cost of electrical energy. In a formal statement published by the company it is stated that the company owns and operates under perpetual franchises the entire gas, electric lighting and power business in the cities of Rockville and Willimantic, the electric light and power service in the towns of Stafford and Ellington, and upon completion of its new pole line will control all the electric lighting and power business in the towns of Coventry, Willington and Mansfield. It is said that a saving of $6,000 will be effected by improvements in gas plants and by the concentration of the clerical and executive departments. Walter H. Learned is president and Alexander J. Campbell is general manager of the company.

WASHINGTON, D. C.—The House of Representatives has passed the bill presented by Charles L. Bartlett, of Macon, Ga., granting a franchise for the construction of a dam across the Savannah River between Edgefield County, South Carolina, and Columbia County, Georgia.

MARIETTA, GA.—Captain R. W. Boone, president of the First National Bank, of Marietta, Ga., recently appointed by the creditors of the Georgia Manufacturing & Public Service Company as trustee, has taken charge of the property, which represents an investment of $350,000, and includes an electric light plant, water works system and paper mill. James T. Anderson is receiver.

WAYCROSS, GA.—The proposition to issue $35,000 in bonds for the construction of an electric-light plant was defeated at an election held July 28. The city also voted against the proposition at an election held June 19. It is said that another election will be called.

KENDRICK, IDAHO.—It is reported that work will soon commence on the construction of an electric plant in Kendrick, franchise for which was granted to Richardson Brothers, of Wallace.

CHAMPAIGN, ILL.—Application has been made to the City Council by the Danville, Urbana & Champaign Railway Company for a franchise to extend its electric railway through the city to connect with the tracks of the St. Louis, Decatur & Champaign Railway Company on Neil Street and with the system of the Urbana & Champaign Railway, Gas & Electric Company on Walnut Street.

FREEPORT, ILL.—C. E. Gregory, of Chicago, Ill., who holds a franchise for the construction of a gas and electric plant in Freeport, has been investigating his interests in this city. Mr. Gregory recently secured an extension of time from the city for the construction of the plant.

LA SALLE, ILL.—Plans are being made by the Chicago, Ottawa & Peoria Railway Company to install two boilers of from 400 to 500 hp each in its La Salle station in the near future.

NORTH CHICAGO, ILL.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 24, for the construction of a system of heating and laying of mains and conduits for the distribution of electricity at the Naval Training Station, North Chicago, Ill. Applications for proposals should refer to Schedule 1483, blank forms for which will be furnished upon application to the navy pay office, Chicago, Ill., or to the above bureau. E. B. Rogers is paymaster-general, U. S. N.

PEORIA, ILL.—The control of the Peoria Gas & Electric Company has been taken over by the Union Railway, Gas & Electric Company, which is a holding corporation for the interests of E. W. Clark & Company, of Philadelphia, Pa., and Hodenpyl, Walbridge & Company, of New York, N. Y. The officers of the Union Railway, Gas & Electric Company are: A. G. Hodenpyl, president; Clarence M. Clark, vice-president, and George E. Hardy, secretary and treasurer.

QUINCY, ILL.—The Trustees of the Soldiers' Home have awarded contracts for equipment for power plant as follows: To the Adams-Bagnall Company, electric lighting system, for $1,086; switchboard, to the General Electric Company, for $1,025; two engines to the Ball Engine Company, for $4,800; Electric Machinery Company, of Minneapolis, Minn., for electrical machinery, for $3,525, and for electric wiring to Kohler Brothers, of St. Louis, Mo., for $5,200.

STREATOR, ILL.—The City Council has granted a 25-year franchise to C. A. King to furnish light, heat and power in Streator.

BLUFFTON, IND.—The Bluffton, Geneva & Celina Traction Company has awarded the contract for the construction of its railway from Bluffton to Geneva to Bears, Brown & Company. Fred Davenport is engineer.

COLUMBIA CITY, IND.—Bids will be received by the Common Council until Aug. 23 for installing two 350-hp vertical water-tube boilers with steel stacks in the municipal water-works and electric-light plant. F. T. Schultz is superintendent.

GOSHEN, IND.—The Goshen municipal electric light system has become antiquated and the City Council has taken steps toward the substitution of a new and up-to-date system. A committee has been appointed to visit other cities where modern plants have been installed and make investigations for the purpose of deciding as to the system to be installed in Goshen.

HARLAN, IND.—Plans are being made by the Fort Wayne & Toledo Electric Railway Company for the construction of its proposed electric railway from Fort Wayne and Maysville, Ind., to Hicksville, Bryan and Toledo, Ohio, a distance of 42 miles, work on the construction of which it is expected will begin about Sept. 15. The Keystone Construction Company, of Indiana, has the contract for building the road. The railway will be operated by the overhead trolley system, electricity for which will be supplied by the Toledo & Indiana Railway Company. E. A. Tennis, of Garden City, Kan., is president of the company, and W. H. Cost, of Harlan, Ind., chief engineer.

INDIANAPOLIS, IND.—The commission appointed to build a State Hospital for tuberculosis patients will receive bids until Aug. 18 at the office of the board, 25 State House, Indianapolis, Ind., for the installation of all the electrical work on the plant in course of construction near Rockville, Ind. I. B. Strouse is secretary.

INDIANAPOLIS, IND.—The proposed plan for lighting the streets of the downtown business district, adopted by the city a few weeks ago, has been abandoned in favor of the scheme offered by the Peacock-Wooley Company, of Chicago, for lighting the streets free of cost, or in consideration of the privilege to conduct an advertising business on the lamps. The change will mean a saving of $10,000 a year to the city. The contract will provide for 10 lamps to the square.

RICHMOND, IND.—Robert Ashe, of this city, has secured a franchise to install an electric light plant at New Paris, Ohio, which is just across the State line. The plan is to transmit the electricity from Richmond to the new plant when completed.

SHELBYVILLE, IND.—The Central Laboratory & Supply Company, of Lafayette, Ind., has secured a contract for the installation of an engine and generator and 848 motors, including the equipment for the Campbell Company's factory in Shelbyville, Ind. J. W. Esterline, of Purdue University, is manager of the Central Laboratory & Supply Company.

SHIRLEY, IND.—The Town Board has engaged George Wallace, of Anderson, to prepare plans for the construction of an electric light plant and water works for this town.

WINGATE, IND.—The Wingate Light Company, organized by C. L. Johnson, of Crawfordsville, Ind., has applied for a 10-year franchise to erect and equip an electric light plant in this city.

RUSSELL, KAN.—At an election held recently the citizens voted to issue $25,000 in bonds for an electric light plant and water-works system.

LOUISVILLE, KY.—Mayor Grinstead on July 26 vetoed the ordinance granting to George G. Fetter the right to extend the boundary line of the territory in which he had been granted a franchise to sell electricity for lighting purposes.

JEANERETTE, LA.—The City Council has granted Henry A. Metz, of New Orleans, La., a franchise to operate a street railway in Jeanerette by electricity or other motive power than steam. Mr. Mentz proposes to construct a railway to connect Jeanerette and other towns of Teche Valley.

AUGUSTA, MAINE.—The Kennebec Light & Heat Company has awarded the contract for the construction of an office and substation at Gardiner to L. E. Bradstreet, of Farmingdale, Maine.

PRESQUE ISLE, MAINE.—Announcement has been made that the Aroostook Valley Railroad Company, which is affiliated with the Canadian Pacific Railway Company, is planning to construct an electric road connecting Presque Isle and Washburn, Maine, with an extension to the St. John River ultimately, a distance of 110 miles. It is stated that a 1200-volt direct-current system will be installed, electricity for which will be furnished by the Maine & New Brunswick Power Company's plant at Aroostook Falls. The proposed railway will carry freight as well as passengers.

ROCKVILLE, MD.—The Town Council has entered into a contract with the Washington Electric Light & Power Company, Washington, D. C., to extend its transmission lines to Rockville and to furnish electricity for lamps for residences and business buildings.

COHASSET, MASS.—The Gas and Electric Light Commissioners have given their approval to the consolidation of the Cohasset Electric Company with the Electric Light & Power Company, of Abington. The last-named company is to pay $18,000 for the property of the former and assume the indebtedness of the Cohasset company.

CONWAY, MASS.—One of the objects of the Boston & Maine Railroad Company in rebuilding the large dam across the South River, where 2000 hp will be developed, is said to be the lighting of the Hoosac Tunnel by electricity. It is also said that the East Deerfield yards will be lighted by electricity; power will also be furnished for the Conway electric lighting and street railway systems as at present.

FITCHBURG, MASS.—The Fitchburg Gas & Electric Light Company has petitioned the Gas and Electric Light Commission for permission to increase its capital stock by $385,000, the proceeds of $275,000 to be used to pay for debts incurred for construction and improvements and $33,000 to be used to complete the work.

NEW BEDFORD, MASS.—The New Bedford Gas & Edison Light Company is handling a well-known make of electric runabouts, which it is advertising on the back of its bill forms for electric service. Charles R. Price is treasurer of the New Bedford Gas & Edison Light Company.

ORANGE, MASS.—The Gas and Electric Light Commission has granted the petition of the Orange Electric Light Company to issue $155,000 additional capital stock, the proceeds to be used to pay outstanding obligations.

SOMERVILLE, MASS.—Mayor John M. Woods has signed a contract with the Edison Electric Illuminating Company for lighting the city for a period of 10 years, under the terms of which the city will save $16,615 per year. Under the new contract the company is to furnish arc lamps at a net rate of $84.08 each per year and incandescent lamps at $18.34 each per annum. The price paid under the previous contract, which expired in 1906, was $105 per year for arc lamps and $30 each for incandescent lamps. In consideration for the new contract the company has agreed to accept a settlement from the city covering the period from the expiration of the old contract to April 30, 1908, at its lowest rate for that period with a 25 per cent discount, and for the remainder of the period until the beginning of the new contract at the same rate as the new contract.

WEST SPRINGFIELD, MASS.—The Board of Selectmen has awarded the contract for lighting the streets and public buildings to the United Electric Light Company, of Springfield, Mass., for a term of five years, under which the company is to furnish 35 arc lamps at the rate of $71.50 each per year and not less than 200 incandescent lamps at $15 per lamp per year. The price for electricity for lighting the public buildings has been reduced from 15 to 7 cents per kw-hour. Under the old contract the city paid $73 for each arc lamp.

WESTFIELD, MASS.—Work has been commenced on the construction of the new engine room of the Westfield Power Company, which will be equipped with a high-speed engine direct connected to an alternating-current generator. The company will supplant the present steam service with electricity.

WORCESTER, MASS.—The Worcester Electric Light Company has filed with the State Gas and Electric Light Commission its appeal from the grant of the Worcester Board of Aldermen to the Connecticut River Power Company.

GRAND RAPIDS, MICH.—The contract for the construction and remodeling the new water-works pumping and municipal electric lighting plant on Canal Street was awarded to Hauser, Owen & Ames, of Grand Rapids, for $89,571.

HOLLAND, MICH.—Equipment, including boilers, electrical apparatus, shafting and other machinery, will be purchased in the near future for a new factory to be erected by the Thompson Manufacturing Company.

MANISTEE, MICH.—The Manistee Iron Works Company has completed its new building and most of the machinery has been installed The new equipment will include a motor-driven planer weighing 60 tons.

NEGAUNEE, MICH.—The Cleveland-Cliffs Iron Company is considering the construction of a hydro-electric power plant with a high-potential generating plant and transmission system, near Negaunee, Mich. The company was recently granted a franchise by the City Council for the construction of an electric transmission line in the city.

YALE, MICH.—Plans are being considered to change the municipal electric light system from direct to alternating current in the near future; also to install a new 125-hp Corliss engine. R. G. Green is superintendent.

CHISHOLM, MINN.—Plans are being made by the Range Power Company for the construction of a new power house and the installation of a new engine. The company has submitted a proposition to the Town Councils of Chisholm and Hibbing in regard to supplying water for both towns. A. McMillan is president of the company.

EVELETH, MINN.—The plant and holdings of the Eveleth Electric Company, which supplies electricity for both public and private lighting in Eveleth, has been sold by the Northen Electric Company, of Fargo, for $50,000. It is understood that the property was purchased by local parties.

NORTHFIELD, MINN.—The general contract for the construction of a central heating and lighting plant for Carleton College was awarded to J. G. Robertson, of St. Paul, Minn., for $37,000. Harlan W. Page is secretary of the board of trustees.

NATCHEZ, MISS.—The Southern Light & Traction Company contemplates improving its power-house and installing additional equipment, including a 500-hp engine, generator for street railway service and generator for the commercial lighting system.

WATER VALLEY, MISS.—Plans are being considered to change the municipal electric light plant to a three-phase system and to install a 1,500,000 or 2,000,000 gal. water-driven pump, of either the triplex or centrifugal type, in the water-works system. T. M. Early is superintendent.

CHILLICOTHE, MO.—The contract for installing an electric light plant at the State Industrial Home for Girls has been awarded to F. B. Wheeler, of Chillicothe, Mo., for $4,838. T. J. Hoge is president of board of managers of the institution.

BROKEN BOW, NEB.—John W. Early, of Columbus, Neb., who was recently granted a franchise to operate an electric plant in Broken Bow, is preparing plans for the construction of the plant, the cost of which is estimated at $25,000. A company will be organized under the name of the Broken Bow Electric Company to operate the system.

SALEM, N. H.—The plant of the Salem Light, Heat & Power Company was purchased at auction July 30 by Frank P. Woodbury, for $7,700, who operated the plant for several years previous to the formation of the company. The company has been in the hands of Arthur O. Fuller, of Exeter, as receiver for several months.

ATLANTIC CITY, N. J.—It is reported that the Atlantic City Electric Light Company is planning to erect a new electric light plant at a cost of about $156,000.

COLUMBIA, N. J.—The contract for the construction of a hydro-electric development across Paulin's Kill, Columbia, for the Warren County Power Company has been awarded to Frank B. Gilbreth, 60 Broadway, New York, N. Y. The contract includes the construction of a Ransom hollow dam 30 ft. high and 350 ft. long, and a reinforced-concrete power house, tailrace, etc. Meikleham & Dinsmore are the engineers.

BROOKLYN, N. Y.—Arrangements are being made to change over the Peter Cooper Glue Factory on Maspeth Avenue from belt to motor drive. The company is in the market for a 125-kw generator, several electric motors and other power equipment.

BROOKLYN, N. Y.—The Public Service Commission, First District, has granted the Brooklyn Heights Railroad Company permission to change the motive power on its Montague Street line from cable to overhead electric system. While it was not a specific condition in the order, it was announced by the company that it has consented to maintain a line of cars between the Wall Street and Fulton ferries in return for the privilege granted.

CARTHAGE, N. Y.—The Carthage Water Power Company has placed contracts with the General Electric Company, Schenectady, N. Y., for two 1000-kw generators. M. S. Wilder is interested in the company.

CELORON, N. Y.—The City Council of Jamestown is considering the question of extending the transmission lines of the municipal electric light plant to Celoron for the purpose of supplying electricity for lamps and motors in that town.

CHARLOTTE, N. Y.—Plans are being made by the Rochester Railway Company to carry the large electric cables between Charlotte and Summerville over, instead of under, the Genesee River. A steel tower will be erected on each side of the river, and arrangements are being made for an elaborate electrical illumination, which will provide for lighting both banks of the river.

ELMIRA, N. Y.—The Elmira Water, Light & Railroad Company has petitioned the City Council for a franchise to construct an extension on Maple Avenue from Miller Street south to the city limits.

FULTON, N. Y.—Operations are under way at the local plant of the American Woolen Company for remodeling the headgates and hydraulic canals, to conform with the 6-ft. "raise" which is to be made in the upper dam. It is said that the company is planning to remodel its plant and install generators to furnish electricity to be used in connection with its mills.

JAMESTOWN, N. Y.—The Jamestown Common Council has applied to the Public Service Commission, Second District, for permission to extend the transmission lines of the municipal electric light plant to Celoron for the purpose of supplyng electricity in that town for lamps and motors.

JAMESTOWN, N. Y.—Arrangements are being made by the Jamestown Iron Works for the construction of a hydro-electric plant to furnish electrical power to operate its foundry and machine shop, contracts for which have been awarded as follows: To the Jamestown Boiler Works for 30-in. steel flume, and to the Dayton Globe Iron Works, of Dayton, Ohio, for a 22-in. water turbine.

LYONS, N. Y.—The Rochester, Syracuse & Eastern Railroad Company has decided to increase the output of its local power plant and will install a 5000-hp turbo-generator set. The boiler capacity of the plant will be increased and transformers will be added. The improvements contemplated will increase the output of the plant to 8400 hp.

MAYVILLE, N. Y.—The Mayville Telephone Company has been reorganized. It is said that the company will make extensions to the system, additional funds for which will be secured by issuing treasury stock. The new officers of the company are: V. A. Kent, president; Samuel C. Crandall, vice-president, and Alton H. Appleby, secretary, treasurer and general manager.

MOUNT VERNON, N. Y.—The Common Council has granted the application of the New York, West Chester & Boston Railway Company for an amended franchise which will enable the company to continue the construction of its four-track rapid transit line, which is to connect Mount Vernon, Pelham, New Rochelle and other towns with the subway. The company has spent $700,000 for rights of way in Mount Vernon, and will expend $800,000 more in construction work. Surveys are also being made for a branch line from Mount Vernon to White Plains. It is stated that construction work will begin in the near future. L. S. Miller is president.

NEW YORK, N. Y.—Plans are being made by the Interborough Rapid Transit Company to install two General Electric 5000-kw, low-pressure turbines, to be operated in connection with reciprocating engines of the same rating in the subway division power house on Fifty-ninth Street and Eleventh Avenue. The order hinges on the satisfactory performance of the 5000-kw unit now installed in the same power house, now undergoing test. The turbines will be vertical machines, driving three-phase, 25-cycle, 11,000-volt induction generators, the leads from which will be connected without switching apparatus to the generators driven by the respective reciprocating engines. The turbines have no governor save for emergency use, and will be equipped with surface condensers.

NEW YORK, N. Y.—The Third Avenue Railroad, through the Third Avenue Bridge Company, has applied to the Public Service Commission, First District, for permission to construct and operate a street-car line over the new Queensboro Bridge to the Borough of Queens. The route of the proposed new street car line will be through Fifty-seventh Street from Third Avenue to Second Avenue, up Second Avenue, through Sixtieth Street to the new bridge. The application states that the new company will operate with the Third Avenue Railroad and will finance the construction of the line by the sale of its capital stock. The commission will give a hearing Aug. 13.

NYACK, N. Y.—The Rockland Light & Power Company has been granted permission by the Public Service Commission, Second District, to issue $100,000 in bonds, under its mortgage dated Dec. 7, 1908. The bonds are to be sold at not less than 90, of which $50,000 are to be used to take up the bonds of the Nyack Gas Light & Fuel Company, now merged with the Rockland Light & Power Company, and the remainder for extensions and improvements.

OSWEGO, N. Y.—A. B. Tenney, of Springfield, Mass., head of the syndicate which recently purchased the plants of the People's Gas & Electric Company, has been in this city investigating the property acquired by the company. It is understood that it is proposed to increase the output of both plants.

PORT JERVIS, N. Y.—The City Council has granted a franchise to the Interstate Hydro Electric Company to construct and operate a plant in this city.

RED HOOK, N. Y.—Plans are being considered by the Red Hook Light, Heat & Power Company for the construction of a hydro-electric power plant at Bingham's Mill, 10 miles north of Red Hook. J. H. Sharpe is president of the company.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is receiving bids for the construction of a two-story machine shop, 30 x 60 ft., to be erected at Andrews and Tenth Streets, which will be used

as a repair shop and charging station for electric automobiles. C. L. Hibler is superintendent.

ROCKVILLE CENTRE, N. Y.—Bonds to the amount of $4,500 have been sold by the Village Trustees, the proceeds to be used for improvements to the municipal electric light plant.

APALACHIA, N. C.—The Carolina-Tennessee Power Company, which has acquired water rights for two hydro-electric power plants on the Hiawassee River, has increased its capital stock from $250,000 to $5,000,000. The company proposes to erect two plants six miles apart, one near the North Carolina-Tennessee boundary, near Apalachia, and will develop 30,000 hp for transmission by electricity within a radius of 100 miles, to Ducktown, Tenn., and Rome, Dalton and Athens, Ga. The cost of the plants is estimated at $4,000,000. The executive offices of the company are at 115 Broadway, New York, N. Y. W. L. Church is president and Stanley R. Ketcham secretary and treasurer.

ASHEVILLE, N. C.—The Asheville Electric Company has filed a mortgage deed to the Old Colony Trust Company, trustee, for the $3,500,000 to secure a bond issuue of the same amount, to be issued as needed by the company, payable July 1, 1939.

HENDERSON, N. C.—Machinery is being installed in the Harriet Cotton Mill No. 2, including 10,000 spindles and other machinery. The mill will be completed about Sept. 1, and will be operated by electricity.

LEXINGTON, N. C.—The Southern Power Company has secured an entrance into the town of Lexington, and will supply electrical power for manufacturing and industrial plants in Lexington.

MONROE, N. C.—The No. 2 mill of the Icemorlee Cotton Mills is nearly completed and ready for installation of the machinery, which will be operated by electricity. The mill will be equipped with 5000 spindles.

BUCYRUS, OHIO.—The Board of Public Service has granted F. C. Kingsbury permission to purchase the plant of the Bucyrus Electric Light Company, under the terms of which he will be required to install all new machinery and equipment in the plant. Mr. Kingsbury was granted a franchise last spring by the Board of Public Service, and also a contract for street lighting, under which street arc lamps are to be furnished on an all-night schedule at $74.50 each per year and $69 per lamp per year on a moonlight schedule.

CANAL DOVER, OHIO.—Plans for the construction of the new municipal electric light plant have been approved by the City Council, which has authorized the Service Board to receive bids and enter into contracts for the power house and equipment for same.

CINCINNATI, OHIO.—A deal has been completed whereby the Columbia Gas & Electric Company, of Cincinnati, Ohio, has purchased sufficient stock to practically control the Union Gas & Electric Company, the deal representing between $7,000,000 and $8,000,000. Negotiations were completed in New York by the managers of the syndicate headed by A. B. Leach, George W. Young and Oscar Gubleman, of New York, N. Y.

CLEVELAND, OHIO.—The Board of Public Service will receive bids until Aug. 17 for 350 kv-amp, 2200-volt, three-phase, 60-cycle, alternating-current, synchronous generator, with exciter, switchboard panel, instruments and attachments, to be installed in the municipal electric light plant. A 350-hp, water-tube boiler, superheater, smoke flue and other appliances will be added to the equipment of the municipal electric plant, bids for which were received Aug. 11. E. H. McIntosh is secretary of Board of Public Service.

COLUMBUS, OHIO.—Plans are being considered by the Board of Prison Managers for the construction of the proposed new power plant to be erected at the penitentiary, contracts for which it is expected will soon be awarded. The plant will cost about $250,000 and will furnish electricity for lighting the penitentiary, the Institution for the Feeble-Minded, in West Broad Street, and the State House.

NEW PARIS, OHIO.—Robert Ashe, of Richmond, Ind., has secured a franchise to install an electric light plant in New Paris. Electricity for operating the system will be supplied from Richmond, Ind.

NORWOOD, OHIO.—The Cincinnati Traction Company has applied to the City Council for a franchise to construct a new street railway into West Norwood. W. K. Schoepf is president.

ANTLERS, OKLA.—The city is reported to have voted to grant a franchise for the construction of an electric-light plant.

ERINDALE, ONT.—It is reported that the Erindale Power Company, recently incorporated, contemplates the construction of a hydro-electric power plant with an initial output of 1000 hp. The entire output of the plant has been purchased by the Interurban Electric Company. E. S. Edmondson, of West Toronto, is manager.

GRANITE, OKLA.—It is stated that bids will soon be asked for the construction and equipment of an electric light and water plant in Granite. The cost of the plants is estimated at $45,000.

HARTSHORN, OKLA.—The Freeborn Engineering & Construction Company, of Kansas City, Mo., is reported to have secured the contract for the construction of the 12,000-bbl. Portland cement plant at Hartshorn, Okla., for the Oklahoma City Portland Cement Company, recently incorporated, with a capital stock of $1,200.000. The buildings will be of steel construction and the machinery operated by electricity. The engineering company has not yet decided upon the equipment for the plant.

CONDON, ORE.—The Wasco County Electric & Water Power Company, capitalized at $3,000,000, has issued a trust deed to secure a bond issue not to exceed $15,000,000. The company proposes to take over the property of the Oregon Gold Prospecting & Promotion Company, which includes 30 miles of water rights on the Deschutes River, and proposes to erect a plant at some point on the Deschutes River within its acquired rights capable of developing 60,000 hp, half of which, it is reported, has been contracted for by the Portland, Baker City & Butte Electric Railroad Company.

EUGENE, ORE.—Arrangements are being made by the Willamette Valley Company for the construction of its new plant, work on which will begin in the near future. The plant when completed will furnish electricity for several cities in Willamette Valley and to operate the proposed electric railway between Eugene and Portland. Plans are also being made to commence work on the construction of the Eugene-Portland early this fall. It is planned to extend the railway as far north as Junction City this fall.

KLAMATH FALLS, ORE.—Plans are being made to establish an electric power plant on the Klamath River and extend transmission lines through Butte Valley to supply electricity in the towns of Dorris, Macdoel and Mt. Hebron for lamps and motors, but principally to furnish electricity for various pumping plants through the valley. Moore Brothers, of Klamath Falls, are interested in the enterprise.

OREGON CITY, ORE.—The City Council has granted a 25-year franchise to F. M. Swift, of the Oregon City, Beaver Creek & Molalla Railway Company, to operate a railway through the Mount Pleasant and Green Point sections of the city. Thomas F. Ryan and G. W. Dimmick are also interested in the enterprise.

PENDLETON, ORE.—Extensive improvements are contemplated at Lohman Springs before another season by Mr. McCormack, the new owner, which will include a new hotel, electric lights, etc. A dam will be built on Frazier Creek a short distance below La Grande Road and the water brought down the valley, where the power plant will be erected. Surveys are now being made and work will commence on construction of the plant as soon as the pipe line is established.

CARLISLE, PA.—The Cumberland Railway Company has taken over the property and holdings of the Carlisle & Mount Holly Railway Company and proposes to construct an extension from Carlisle to Newville, a distance of 12 miles, and later to Shippensburg. John Graham, of Newville, is president of the Cumberland Railway Company, and W. F. Pascoe, of Carlisle, general manager.

NEW CASTLE, PA.—The Mahoning & Shenango Railway & Light Company has recently purchased a 600-kw Westinghouse motor generator set and a 200-kw General Electric motor generator set.

PITTSBURGH, PA.—It is reported that the Duquesne Light Company will soon erect another large power plant to take care of its increasing business in the business district of the city.

READING, PA.—The Boyertown & Pottstown Street Railway Company has commenced work on the construction of a substation at its park in Reading. W. J. Hardaker is superintendent.

READING, PA.—A new plant is being erected by the Steiner & Talcott Silk Company on Chestnut Street between Fifth and Sixth Streets, which will double the output of the present factory. The power house will be 33 ft. by 40 ft. and one story high.

WILKES-BARRE, PA.—Negotiations between the city authorities and the Wilkes-Barre Gas & Electric Company for lighting the city for a term of seven years have been completed.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company has made a proposition to the Board of Contract and Supply relative to installing a turbine at the Hope high-service pumping station and entering into a contract with the company to supply electricity to operate the same, by which, it claims, the city would save $30,000. The city is now considering bids for the installation of a new pumping engine for the station.

SALUDA, S. C.—The plant and holdings of the Saluda Telephone Company have been purchased by A. J. Day, of Trenton, S. C. It is said that the new owner will enlarge the system, install an exchange and construct several rural lines, including one to Higgins Ferry and Coleman.

SPARTANBURG, S. C.—A proposition is under consideration for the building of an interurban electric railway to connect Glenn Springs, 15 miles distant, and Union, 30 miles distant. General Manager F. H. Knox, of the local electric power company; J. B. Lee, president of the Glenn Springs Hotel, and others are interested in the project.

ABERDEEN, S. D.—The Aberdeen Light & Power Company, it is stated, is planning to enlarge its plant at a cost of $30,000. A new building will be erected; a third engine has been ordered and an additional 200-kw generator will be installed.

HILL CITY, S. D.—R. T. Walker, of the Gold Medal Mining Company, is interested in a water-power project. The company has recently been organized and proposes to install electrical machinery and utilize the energy for mining purposes and for lighting the town as soon as the company can secure the necessary funds. It is proposed to develop about 200 hp. Mr. Walker would like to communicate with someone who would finance the company or put up the capital required to build the flume and install the machinery. The cost of the work is estimated at $40,000.

MEMPHIS, TENN.—It is reported that Ford, Bacon & Davis, consulting engineers, are receiving bids through their New Orleans office for an extensive addition to the power plant of the Memphis Street Railway Company, of Memphis, Tenn., which will include the construction of power house and equipment, the cost of which is estimated at about $100,000.

NASHVILLE, TENN.—The City Council has granted the Nashville Railway & Light Company a franchise to extend its system from Sixteenth Street on Broad Street out to Hillsboro Pike.

BRYAN, TEX.—The City Council has granted a franchise to Judge V. B. Hudson to construct an electric railway from Bryan to the Agriculture and Mechanical College, a distance of five miles.

CORPUS CHRISTI, TEX.—The City Council has granted Daniel Hewitt, of Salina, Kan., a franchise to construct and operate an electric railway in Corpus Christi.

GREENVILLE, TEX.—The Allis-Chalmers, of Milwaukee, Wis., has secured the contract for the equipment of the municipal electric light plant. The contract calls for an expenditure of about $38,000, the machinery to be delivered in 90 days. The J. W. Maxey Company, of Houston, Tex., has charge of the engineering work.

MART, TEX.—The Mart Light & Power Company has commenced work on the construction of a new plant to replace the one recently destroyed by fire. Temporary quarters have already been erected.

MEDICINE MOUND, TEX.—W. J. Johnson and associates are interested in a project to construct an electric railway from Quanan to Medicine Mound, a distance of 18 miles. For further information address Mr. Johnson, care of Porter A. Whaley, Quanah, Tex.

RICHFIELD, UTAH.—The Jumbo Plaster Company contemplates installing an electric light plant to enable it to operate night shifts.

SALT LAKE CITY, UTAH.—Application has been filed with the state engineer by Thomas A. Starrh and Wilford Allen, both of Salt Lake City, to appropriate 7 cu. ft. of water per second from North Dry Creek in Salt Lake County. It is proposed to pipe the water a distance of 9150 ft., where it will be utilized to generate 1000 hp, which will be used for lamps and motors three miles northeast of Draper.

WILLARD, UTAH.—The Willard Power Company has completed its transmission line into Weber County, and it is stated that the company will furnish electricity to operate the street-railway system in Ogden from the local plant. Messrs. Browing and Eccles, principal owners, are said to be contemplating the extension of the Hot Springs line through Willard to Brigham, as soon as feasible, electricity for which will be supplied by the Willard plant.

BIG STONE GAP, VA.—Bids will be received by the City of Big Stone Gap until Aug. 12 for franchise, rights, etc., for the establishment of a proposed telephone system. J. S. Wright is town recorder.

BIG STONE GAP, VA.—The Virginia & Tennessee Telephone Company is planning to extend its telephone service to the Wise coal fields, and erect a 60-mile line to Middleboro, Ky., and also to put Bristol and other towns in closer connection with the Southern Bell system.

ST. PETERSBURG, VA.—The St. Petersburg Telephone Company is making extensions into outlying districts.

ENTIAT, WASH.—Active operations have been resumed by the Entiat Light & Power Company on its local power-house and it is expected to have the plant in operation early this fall.

INDEX, WASH.—Plans are being made by J. A. Soderberg and associates, who recently filed water rights on the Skykomish River, in this State, to erect a power plant to furnish electricity for lamps and motors to several towns along the Great Northern Railway.

PESHASTIN, WASH.—The generating equipment of the Valley Power Company's plant in Peshastin will be doubled.

WALLA WALLA, WASH.—Dement Brothers, of Walla Walla, have secured riparian rights on the Salmon River, near its junction with the Columbia River, necessary to construct a power plant.

WALLA WALLA, WASH.—It is reported that the project to develop the water power of the John Day and Deschutes rivers, which was abandoned by the Government several years ago, will be taken up by a private enterprise. A company has been incorporated, with a capital stock of $500,000, which proposes to utilize the water power to generate electricity and for irrigation and power purposes. The incorporators are: Prof. W. D. Lyman, of Whitman College; Y. C. Blalock and W. J. Karinor, of Blalock, Ore.

ANTIGO, WIS.—Plans are being made by the Antigo Electric Company for a new generating system, which include the construction of a large power station to be equipped with tubular boilers, a Corliss engine or steam turbine and alternating-current dynamos, replacing the present direct-current apparatus, for which contracts have been awarded as follows: To the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for electrical apparatus, and for engines, to the Nordberg Manufacturing Company, of Milwaukee, Wis.

APPLETON, WIS.—The Kimberly & Clark Company, it is reported, will construct an electric power house on the site of the old Vulcan mill in the near future.

ASHLAND, WIS.—The Ashland Light & Power Company, it is reported, will purchase electrical equipment for a new substation to be erected in this city.

EDGERTON, WIS.—The plant of the Edgerton Electric Light Company, which has been taken over by the Janesville Electric Company, of Edgerton, Wis., will be changed from a 133-cycle, single-phase system to 60-cycle, three-phase, and the distributing system will also be greatly improved.

MILWAUKEE, WIS.—The contract for installing a small electric generating unit in the North Avenue pumping station has been awarded to George F. Rohn, of Milwaukee.

NEW RICHMOND, WIS.—The plants and holdings of the Apple River Power Company in this city and the two power plants on the Apple River, one located at Somerset and the other in Riverdale, have been taken over by the recently organized Washington County Light & Power Company, of Stillwater, Minn. It is said that extensive improvements to the plants are contemplated. The officers of the Washington County Light & Power Company are: Homer W. McCoy, of Chicago, Ill., president; M. P. McNally, of New Richmond, Ind., vice-president, and E. P. Manwarring, of Stillwater, Minn., secretary and treasurer.

VIOLA, WIS.—E. R. Cushman has fine water-power rights for sale, which local parties have been trying to secure for an electric-light plant, but negotiations have fallen through. Mr. Cushman will be glad to correspond with parties interested in the subject. The village has a population of 1000 and is in need of a lighting service.

WATERLOO, WIS.—Plans are being made to rebuild the plant of the G. B. Lewis Company, which was recently destroyed by fire. It is said that the plant will be equipped for electric motor drive.

WAUKESHA, WIS.—Application has been made to the City Council by the Milwaukee Western Electric Railway Company for a franchise in Waukesha, via North Street.

BRACEBRIDGE, ONT., CAN.—The by-law to raise $65,000 for the purpose of developing additional water power at Wilson's Falls, two miles up the Muskoka River, was carried at an election held Aug. 2. This enterprise will be an addition to the municipal plant already in operation.

LONDON, ONT., CAN.—The Bell Telephone Company of Canada will place its wires underground in this city, at a cost of about $50,000.

TORONTO, ONT., CAN.—Contracts for the construction of the transformer stations at Toronto and London have been awarded by the Hydro-Electric Power Commission. Witchall & Son, of Toronto, secured the contract for the station at Toronto, for $36,500, and Hyatt Brothers, of London, the London station, for $23,500. The contracts for the remaining eight stations, at Woodstock, Paris, Berlin, Stratford, St. Mary's, Preston, St. Thomas and Guelph, will be let soon. John Hayman & Sons, of London, Ont., have submitted a tender for all the stations of $148,000, or $18,500 for each building.

REGINA, SASK., CAN.—The Saskatchewan Government has awarded a contract to J. S. Bartleman, of Regina, Sask., for the construction of the long distance telephone line between Saskatoon and Prince Albert. Connections have also been made at Fillmore between the Government telephone systems of Manitoba and Saskatchewan.

CIENFUEGOS, CUBA.—The Cienfuegos, Palmira & Cruces Electric Railway & Power Company expects to place contracts for the construction of 30 miles of railway between Cienfuegos and Manicaragun, within two months. Contracts for rails have already been placed. Hugh J. Reilly, of Cienfuegos, Cuba, contractor, wishes to purchase two gasoline motors; the company has a concession for the development of water power, and will probably use electricity to operate the railway.

GUANAJUATO, MEX.—Arrangements are being made by the Guanajuato Power & Electric Company for the construction of another large hydro-electric plant, work on which will commence in a few weeks. The plant when completed will have an output of 10,000 hp, and will make the third one erected by the company. The new plant will be located about seven miles above the Brunel plant, and will be connected with it.

MEXICO CITY, MEX.—F. de J. Villareal, of Satillo, Mex., who owns a short line of railroad which runs from Allende, on the Mexican International road, to Zaragoza, has sold the property to a syndicate of Americans, who are preparing to extend the road to Las Vacas, situated on the bank of the Rio Grande opposite Del Rio, Tex. The road will be about 100 miles long when finished, and is to be operated by electricity. It will do both a freight and passenger business, but its primary object is to afford a transportation outlet for the products of the lands.

New Industrial Companies.

THE AZTEC ENGINEERING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $5,000, and proposes to do a general contracting and building business. The incorporators are Stephen A. Whisten, Thomas J. Buckley and J. Edward Murphy, all of New York, N. Y.

THE BERGEN AUTO COMPANY, of Rutherford, N. J., has been incorporated, with a capital stock of $50,000, to manufacture motors, engines, machine supplies, engineering appliances, etc., by E. Steffens, Jr., and J. F. Steffens, of Rutherford, N. J.

THE DELAWARE RAILROAD CONSTRUCTION COMPANY has filed articles for incorporation with the Secretary of State, Dover, Del., with a capital stock of $100,000. The incorporators are: J. Lord, of Dover, Del.; D. E. Ratten and W. S. Allen, of Philadelphia, Pa.

THE ELECTRIC AMPLIPHONE COMPANY, of Wilmington, Del., has been incorporated, with a capital stock of $250,000, by G. M. Wallace, of Camden, N. J.; P. J. Dougherty, of Philadelphia, Pa., and T. Ritchie, of Wilmington, Del.

THE ENGINEERING & DEVELOPMENT COMPANY has filed articles of incorporation, with a capital stock of $25,000. The incorporators are F. C. Rockafellow, G. F. Coffin and C. Snyder, of Easton, Pa.

THE FREIGHT HANDLING MACHINERY COMPANY, of Jersey City, N. J., has been incorporated by G. H. Stephens, B. W. Tucker, R. D. Steel, H. M. Behren and J. E. Potbury, all of Jersey City. The company is capitalized at $100,000 and proposes to manufacture machinery, cable ways, hoists, etc.

THE HERZOG ELEVATOR SIGNALS COMPANY, of Newark, N. J., has filed articles of incorporation for the purpose of manufacturing elevator signals and appliances. The company is capitalized at $500,000 and the incorporators are: W. J. Connor, T. F. Mulvaney and W. H. Saunders, of Jersey City, N. J.

THE HOLMES CONTRACTING COMPANY, of New York, N. Y., has been incorporated by E. A. Holmes, G. B. Walbridge and F. W. Colwell, of New York, N. Y., as general contractors for the construction of roads, railways, power plants, etc.

THE G. J. HORNUNG CONTRACTING COMPANY, of West New York, N. J., has filed articles of incorporation for the purpose of doing a general contracting business in public and private improvements. The company is capitalized at $50,000 and the incorporators are: C. J. Hornung, J. Burkart and S. Miller, of Guttenberg, N. J.

THE HUSSON MOTOR COMPANY OF AMERICA, of New York, N. Y., has been incorporated, with a capital stock of $12,000, for the purpose of manufacturing gas engines, motors, machines, automobiles, aerial vehicles, motor boats, etc. The incorporators are John Husson, of New York, N. Y.; John J. Hogan, of West Haven, Conn., and William E. Young, of New York, N. Y.

THE NATIONAL BATTERY FAN COMPANY has filed articles of incorporation with the Secretary of State, Dover, Del., with a capital stock of $600,000. The incorporators are: W. I. N. Lofland, W. F. P. Lofland and S. C. Y. Ware, of Dover, Del.

THE NATIONAL APPLIANCE COMPANY, of Chicago, Ill., has been incorporated by Heldman & Street, 1242 Monadnock Block, Chicago, Ill., for the purpose of manufacturing railway appliances. The company is capitalized at $10,000.

THE RAILWAY BUILDING & OPERATING COMPANY, of Camden, N. J., has been incorporated by C. T. Leland, C. W. Rambo and W. B. MacDonald, of Camden, N. J. The company is capitalized at $125,000 and proposes to construct railroads, telephone and telegraph lines, etc.

THE SCIENTIFIC AEROPLANE & AIRSHIP COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, to manufacture, sell and operate airships. The incorporators are: H. C. Beach, W. A. Haynes and H. C. Evans, of New York, N. Y.

C. F. SPLITDORF, of New York, N. Y., has filed articles of incorporation, with a capital stock of $500,000, for the purpose of manufacturing electrical machinery, ignition apparatus, automobile parts and sundries. The incororators are: C. F. Splitdorf and J. Splitdorf, of New York, N. Y., and P. J. W. Kelly, of Jersey City, N. J.

THE TURBO ENGINEERING COMPANY, of Chicago, Ill., has filed articles of incorporation, with a capital stock of $25,000, and proposes to do a general engineering and contracting business. The incorporators are C. A. S. Howlett, W. L. Stockton and H. Hertz.

Company Elections.

PITTSFIELD, MASS.—At the annual meeting of the Pittsfield Electric Company held July 30 the following-named officers were elected: Alexander Kennedy, president and treasurer; William L. Adam, clerk. Directors were elected as follows: W. L. Adam, S. G. Colt, Alexander Kennedy, James W. Hull, Charles E. Merrill, Henry R. Pierson and A. H. Rice.

NASHUA, N. H.—At the annual meeting of the stockholders of the Nashua Light, Heat & Power Company the following-named directors were elected: F. W. Estabrook, F. E. Anderson, James H. Tolles, George E. Anderdon and Elbert Wheeler. The directors later elected officers as follows: F. W. Estabrook, president; James H. Tolles, clerk; Elbert Wheeler, treasurer; George L. Sadler, superintendent electrical division, and Walter F. Norton, superintendent gas division.

New Incorporations.

FORDYCE, ARK.—The Southern Telephone Company, of Fordyce, has been granted a charter, with a capital stock of $1,000,000, and proposes to construct and operate telephone and telegraph lines throughout the State. The incorporators are: A. B. Banks, president; C. B. Kyle, T. A. Munroe, William Wopfer and Dr. J. H. Middleton.

FORT WAYNE, IND.—Articles of incorporation have been filed by the Fort Wayne & Toledo Electric Railway Company, which intends to construct an electric railway from Fort Wayne to Bryan, Ohio, a distance of 55 miles, with headquarters at the former city. It has an authorized capital stock of $100,000, and the incorporators are E. A. Tennis, Garden City, Kan.; H. C. Baker, Philadelphia, Pa., and R. L. Bastress.

WARRINGTON, IND.—The Warrington Telephone Company has been organized and incorporated for the purpose of constructing, equipping and operating a telephone exchange in this city and extending its lines throughout the north part of Hancock County. The directors, headed by W. J. Kennedy, are in the market for material and equipment.

VICKSBURG, MISS.—The Mississippi Electric Company, capitalized at $10,000, has been incorporated by A. A. Woods, A. M. Paxton and others.

CARTHAGE, N. Y.—The Oswegatchie Hydraulic Power Company, of this city, has been incorporated for the purpose of generating and selling electricity, but not for public purposes. It has an authorized capital stock of $100,000, and the incorporators are: Mark S. Wilder, M. C. Wilder and F. P. Wilder, all of Carthage.

GILBOA, N. Y.—Articles of incorporation have been filed by the Gilboa Electric Light, Heat & Power Company, which is capitalized at $25,000, and the following directors have been elected: E. E. Billings, E. S. Persons, Sidney Rivenburgh, J. M. Case, G. M. Wyckoff, E. Hulbert, N. C. Wyckoff, F. S. Lewis and J. M. Cronk.

GREENSBORO, N. C.—The Southeast Guilford Telephone Company has been chartered, with a capital stock of $25,000, by C. S. Gilmer, of Greensboro, and others.

CLEVELAND, OHIO.—The Cleveland Traction Company has been incorporated to construct an electric railway in this city. It is understood that Herman J. Schmidt, one of the incorporators, intends to transfer his franchise rights in Cleveland to the new organization. Others interested in the new project are: A. F. May, O. F. Leisey, T. G. Fitzsimmons and James Lawrence.

PENDLETON, ORE.—Articles of incorporation have been filed for the Farmers' Railway & Navigation Company to construct a railway to be operated by electricity, gasoline or steam to connect Umatilla, Holdman, Helix, Hermiston, Echo and Pendleton. The company is capitalized at $250,000. The officers are: Charles A. Hill, of Pendleton, president; A. A. Cole, of Pendleton, secretary and treasurer, and E. T. Erickson, of Hermiston, Ore., chief engineer.

PENDLETON, ORE.—Articles of incorporation have been filed by the Umatilla Railway & Electric Power Company, whose purpose is to construct an electric railway connecting Pendleton, Pilot Rock, Nye, Alba, Umatilla and other places. It is planned to construct about 200 miles of line in Umatilla County, surveys for which are being made, and to develop power from Camas Creek. The company is capitalized at $100,000, and the incorporators are: C. J. Smith, Pendleton; D. Belts and A. R. Turner.

AMBRIDGE, PA.—Application for a charter has been made by the People's Electric Company, whose intention is to generate and sell electricity for light, heat and industrial purposes. Those interested in the new corporation are: E. H. Jennings, Pittsburgh, Pa.; L. A. Meyram, Pittsburgh; F. A. McVay, of Sewickley, Pa., and others.

HOUSTON, TEX.—Articles of incorporation have been filed by the Westmoreland Railroad Company, those interested in the enterprise being W. W. Baldwin, Max Eggert, A. J. Condit and R. B. Henderson. The new concern has an authorized capital stock of $40,000, and proposes to construct an electric line from Houston to Bellaire, a distance of about 7 miles.

MARSHALL, TEX.—The Marshall Traction Company has been incorporated with a capital stock of $25,000 for the purpose of constructing an electric railway within the corporate limits of Marshall. Among those interested in the enterprise are: Marvin Turney, F. H. Prendergast, John Copeland and others.

SAN MARCOS, TEX.—The San Marcos Utlities Company, whose charter includes the privilege of establishing an electric light plant at this city, has been incorporated, with a capital stock of $200,000, by V. L. Brooks and others.

SUFFOLK, VA.—Articles of incorporation have been filed by the Suffolk Gas & Electric Company. It has an authorized capital stock of $15,000, and the following officers have been elected: W. H. Venable, president; W. W. Starke, vice-president, and M. G. Mulvey, secretary and treasurer.

STARBUCK, WASH.—Following the acquisition of the Starbuck Electric Light & Power Company's plant, formerly the property of Dr. Marcel Pietrzycki, of Dayton, by A. E. Bryan, of the Washington State College, articles of incorporation were filed for the Starbuck Electric Company. The new concern is capitalized at $25,000, and others interested are H. Bryan, A. W. Bryan and Thomas Neill. The new company proposes, in addition to supplying power for lighting Starbuck, to construct and operate water works and furnish power for manufacturing purposes.

CHARLESTON, W. VA.—The Kanawha & Ohio Valley Traction Company has been chartered by George S. Couch, F. P. Grosscup and others, of Charleston, to construct an electric railway from Kanawha Falls on the Kanawha River to Point Pleasant, surveys for which are now being made between Charleston and Kanawha Falls.

FAYETTEVILLE, W. VA.—The Fayette Public Service Corporation, which is capitalized at $20,000, has filed articles of incorporation, and taken over the franchise recently granted to R. H. Dickinson for the construction of an electric lighting system at this city. The original plan outlined by Mr. Dickinson, who is one of the incorporators of the company, for securing power from the Stuart Colliery Company's plant and erecting transmission lines therefrom to Fayetteville and Oak Hill, will be adhered to. The officers of the company are: J. P. Davis, Stuart,

W. Va., president and general manager; J. P. Staton, Glen Jean, W. Va., vice-president, and R. J. Stegall, Glen Jean, secretary and treasurer.

WHEELING, W. VA.—Articles of incorporation have been filed by the Warwood Water & Light Company, of Warwood (post office Wheeling, W. Va.). The capital stock is placed at $50,000, and the incorporators are: B. W. Peterson, John A. Moore, James W. Ewing, Edmund P. Hunter and others.

Legal.

DUTY OF ELECTRICAL COMPANIES TOWARD PERSONS USING THE HIGHWAYS.—It has been held in different cases that electric light companies are not insurers of the public using the streets over which their wires are strung on poles, and are therefore not liable for all injuries resulting from contact with their wires, irrespective of the circumstances under which they occur. What they are liable for is the exercise of that degree of care which the law imposes upon them in view of the dangerous character of their wires and the rights of the public in the highways over which they are suspended. In a recent Maryland case it appeared that, while the plaintiff, a boy of eight years old, was passing along a public street of Baltimore he swung himself around a pole standing in the pavement, when he came in contact with a hanging wire charged with electricity and badly burned his head and his hand. The evidence did not show the existence of any sudden or unforeseen cause for the falling of the wire, nor show with certainty whether it fell before or at the time of its coming in contact with the boy. It was held that, in view of the exceedingly dangerous character of electric light and power wires, and the peril to which their suspension over the public streets exposes the public who constantly traverse and use the streets, the injury of a person upon the surface of the street by contact with a hanging or fallen wire, in itself, if unexplained, affords sufficient *prima facie* evidence of negligence on the part of the owner of the wire to entitle the plaintiff to go to the jury in an action for damages for the injury. Walter vs. Baltimore Electric Company, Court of Appeals of Maryland, 71 Atl. Rep. 952.

ELECTRIC COMPANY NOT LIABLE FOR FRIGHTENING A HORSE.—An action was brought against a telephone company on the ground that the plaintiff's horse took fright at a reel of pipe being used by the company and ran away. The defendant telephone company had acquired from the proper authority the right to erect and maintain "telephone poles and wires to be placed thereon, together with such supporting and strengthening fixtures and wires as the company might deem requisite." In the erection of its plant the company made use of cables or groups of wires inclosed in lead pipe a little over an inch in diameter and wound on wooden reels so constructed that they could be mounted on axles. The defendant's foreman of construction sent men to string cables on the poles already erected. For this work some of the men under his direction placed one of these reels of lead pipe on the side of the street next the sidewalk and in the line of the poles upon which the cables were to be strung. While the men were at work upon the poles and wires preparing to string the cables and pipe, but before they had begun to unwind the pipe from the reel, the plaintiff, driving his horse along the street, came toward the reel, when the horse became frightened from the appearance of the reel, or of the lead pipe wound around it, and ran away, to the plaintiff's injury. In holding the company free from liability, the Court said: "It is not the law that economic progress is to be arrested or even turned aside whenever a well-broken horse, carefully driven, is frightened or likely to be frightened thereby. To say that well-broken horses, carefully driven, must not be frightened, is to say that no new appliance, however useful, shall be used on or near highways. In this age of economic progress it is the more reasonable and workable, and hence the legal, rule that owners and drivers of horses should recognize that the highways are not exclusively for their use; that other and new instrumentalities for transportation and transmission, and appliances for their construction and maintenance, are often legally allowed upon the highways; and that they should early accustom their horses to whatever new conditions thus arise, and be on their guard against them. In this case it was as much incumbent on the plaintiff as on the defendant to foresee that his horse might be frightened by the reel or the lead pipe, and have taken measures to avoid or prevent the possible consequences. The reel and the lead pipe being otherwise lawfully where and when they were in the street, the mere fact that they were likely to frighten horses unaccustomed to them did not make their presence there unlawful. The consequences of the fright must therefore remain where they fell." Simonds vs. Maine Telephone & Telegraph Company, Supreme Judicial Court of Maine, 72 Atl. Rep. 175.

Personal.

MR. ALTON S. MILLER, formerly vice-president and general manager of the Consolidated Gas, Electric Light & Power Company, of Baltimore, has assumed duties in a similar capacity with the Union Electric Light & Power Company, St. Louis, Mo.

PROF. MORGAN BROOKS, of the electrical engineering department of the University of Illinois, has a year's leave of absence, giving him a rest of which he stands greatly in need. He will take a trip around the world, first spending about three months in Europe.

MR. H. B. HERYFORD has resigned as local manager of the Colusa Gas & Electric Company, Colusa, Cal., to accept the position as manager of the Chico Gas & Electric Company, Chico, Cal. Mr. William H. Henderson, of Sacramento, Cal., has succeeded Mr. Heryford as local manager of the Colusa Gas & Electric Company.

MR. AND MRS. SAMUEL INSULL, SR., and Miss Insull, of London, the father, mother and sister of Mr. Samuel Insull, of Chicago, president of the Commonwealth Edison Company, are spending the summer in this country as the guests of their Chicago relative at Mr. Insull's farm at Libertyville, Ill. The London Insulls will return to England in September.

MR. CHARLES MACLOSKIE, of Brussels, who has been spending a short vacation in New York State, sailed for home on Thursday, Aug. 5. Mr. Macloskie is one of the well-known men of the industry, having been identified with the Bentley-Knight Company, the Thomson-Houston Company and the Allgemeine Elektricitäts Gesellschaft. He was engineer of the intra-mural road at the Chicago World's Fair.

PROFESSOR F. B. CROCKER, of the electrical engineering department of Columbia University, New York City, has leave of absence and, starting in October, will make a trip around the world. He circumnavigated the globe 11 years ago, and was in Manila while things were very warlike. He is interested to study at first hand the tremendous changes that have happened since then in the Far East.

MR. HUGO REISINGER.—At Berlin on Aug. 9, Emperor William conferred the Crown Order of the Second Class on Mr. Hugo Reisinger, the well-known carbon and electrical importer of New York. This honor was in well-deserved recognition of services in helping to organize the splendid exhibit of modern German art at the Metropolitan Museum of Art last January. Mr. Reisinger has shown much public spirit in efforts of this character.

MR. R. W. SEARS, one of the founders of the great mail order business of Sears, Roebuck & Company, has just retired from business at the age of 45 with a fortune of $25,000,000, having sold his holdings in the concern. He was formerly a telegraph operator, and while working at the key developed among his fellow employees the ideas and methods which later laid the foundation of the great enterprise. He began with selling watches by mail. He will now live and work on his model farm in Illinois.

MR. ARTHUR EASTMAN CLIFFORD, second vice-president of the McGraw Publishing Company, New York, was married to Miss Jean Fergus on the evening of Aug. 3 at the residence of the bride's parents, Mr. and Mrs. George H. Fergus, 415 Sheridan Road, Chicago. Mrs. Frank Bartsch, of Omaha, sister of the bride, was matron of honor. There was a large gathering of friends to witness the ceremony, which was performed by Rev. Dr. R. H. F. Gairdner. Mr. and Mrs. Clifford are spending their honeymoon on the Great Lakes and at summer resorts in New York State. They will be at home in New York about Sept. 1.

Obituary.

DR. O. FRÖLICH.—It is with great regret that we note the death of Dr. O. Frölich at Berlin, Germany, at the age of 66. He is fittingly spoken of as one of the pioneers of the modern electrical industry. He was associated with the great firm of Siemens & Halske in its early telegraph days, but as the art expanded he grew and advanced with it. He took up in turn the development of the dynamo-electric machine and gave much time to the perfection of electrical measuring instruments. He was of late years lecturer at the Charlottenburg Technical High School and always maintained a strong interest in pure science and scientific research for its own sake.

Trade Publications.

RECEPTACLES.—A complete price list of receptacles for decorating work, outlining buildings, suspension and festooning is given in bulletin No. 522 of Pass & Seymour, Solway, N. Y.

MOTOR STARTERS.—The Automatic Switch Company, 131 Liberty Street, New York, has issued as additions to its loose-leaf catalog sections Nos. 12 and 25, dealing with magnet switches and automatic starters for electric motors.

MOTOR-DRIVEN PUMPS.—Pumps designed particularly for furnishing water to residences, garages, stables, etc., and arranged for driving electric motors, are illustrated, listed and described in a loose-leaf catalog issued by the Jarvis Engine & Machine Works, Lansing, Mich.

ELECTRIC MEASURING INSTRUMENTS.—The bulletin issued by the Hoyt Electrical Instrument Works, Penacook, N. H., gives much information concerning ammeters, voltmeters and a combined voltmeter and ammeter known as the volt-ammeter. These instruments are intended for direct-current circuits, and are characterized by neatness and compactness.

PUMPS.—Catalog No. 32 of the Du Bois Iron Works, Du Bois, Pa., is a well-prepared 32-page publication relating to pumps arranged for steam, electric and gasoline engine and air-driving. These pumps are designed for all service for which pumps can be used.

SILENT CHAINS.—Silent-running, flexible gearing, involving the use of steel chains, is treated briefly in a well-illustrated bulletin, designated as No. 8, issued by the Morse Chain Company, Ithaca, N. Y. These chains are built for drives ranging from ¼ to 1000 hp.

STORAGE BATTERIES.—A sketch of the development of the Exide and the Hycap-Exide storage batteries is contained in a neatly executed booklet issued by the Electric Storage Battery Company, Philadelphia, Pa. These batteries are used extensively for electric vehicles.

FUEL ECONOMIZERS.—The Green Fuel Economizer Company, Matteawan, N. Y., has issued a booklet, entitled "How to Save Coal," which presents in a convincing manner the advantages to be derived from the use of the so-called fuel economizers, which utilize heat otherwise wasted through gases.

PISTON PUMPS.—The Goulds Manufacturing Company, Seneca Falls, N. Y., is distributing a mailing card for calling attention to its double-acting piston pump, particularly adapted for domestic service. These pumps are provided with wheels, and are well arranged for driving by electric motor.

SPEED INDICATORS AND RECORDERS.—Schuchardt & Schutte, 90 West Street, New York, have issued a booklet entitled "Tachometers and Tachographs," which deals with devices for indicating and recording rotative speed. There is also described and illustrated the so-called cut-meter, which indicates the peripheral speed of a shaft or similar device being turned in a lathe.

HIGH-VOLTAGE DIRECT-CURRENT RAILWAY.—Bulletin No. 4673 issued by the General Electric Company describes the Pittsburgh, Harmony, Butler & New Castle 1200-volt direct-current railway. The bulletin contains numerous illustrations, and gives a more or less detailed description of the road, its equipment and operation, and should be of interest to railway men.

THE PHILADELPHIA BATTERY.—Some excellent literature is issued by the Philadelphia Storage Battery Company, Emerald and Tioga Streets, in regard to its various cells, including those for vehicles, for lighting and for automobile ignition. This battery has been very largely used for electric vehicles, and the reports are most satisfactory from users as to life and endurance, with large capacity steadily sustained. The company keeps in close touch with customers by means of regular reports and issues instructions that are clear and concise and that, if followed, will insure fair and proper treatment of the battery under all conditions of service. Full details are given as to the construction of the battery, and all the parts are illustrated in the descriptive pamphlets. Prices are also given.

ELECTRIC HEATING DEVICES.—The extent to which electricity is now being used for heating purposes will be appreciated from the fact that the latest catalog of the American Electric Heater Company, Detroit, Mich., is a 100-page publication, most all of which is devoted to descriptive matter relating to heating devices. In addition to the material of a purely catalog nature, a certain amount of technical information relating to the cost of operation, etc., is included. The devices described are smoothing-irons, stoves, water-heaters, toasters, coffee-percolators, chafing-dishes, warming-pans, air-heaters, hot-water urns, coffee urns, plate-warmers, foot-warmers, hair-dryers, curling-iron heaters, broilers, griddles, ovens, sterilizers, soldering-irons, glue-pots, wax-heaters, shoe iron tools and branders.

Business Notes.

GENERAL ELECTRIC COMPRESSORS.—The General Electric Company has introduced recently centrifugal air compressors of two kinds. The first is a single stage apparatus, which takes care of pressures from 1 lb. to 3½ lb. The more important development, however, is a compressor for blowing blast furnaces and similar apparatus, where large volumes and pressures of from 10 lb. to 30 lb. are involved.

THE HOLOPHANE COMPANY, 227 Fulton Street, New York, has announced that, beginning on Sept. 1, its steel-reflector department will have several engineers working exclusively upon factory and shop lighting. These engineers will be prepared to undertake any problem in industrial lighting that may be offered, and their services are placed, without charge, at the disposal of central stations, electrical contractors and supply dealers.

THE DICKINSON MANUFACTURING COMPANY, Springfield, Mass., announces that, by the registration of the "Gummon" trade-mark in the United States and in many principal foreign countries, it is legally granted the exclusive right to the use of the name "Gummon" and the symbol thereof in the marketing of all substances for molded electrical insulation based upon qualities claimed for Gummon. This material is said to be capable of withstanding a temperature of 500 deg. Fahr., while retaining its insulating properties.

THE WOODS MOTOR VEHICLE COMPANY.—Owing to the growth of its business, the Woods Motor Vehicle Company, maker of electric pleasure vehicles, is building an addition to its factory at Calumet Avenue and Twenty-fifth Street, Chicago. The new structure, with brick front and of reinforced concrete construction, will consist of four stories and basement, with ground dimensions of 60 ft. x 120 ft., and it will extend through to Cottage Grove Avenue from Calumet Avenue. It will add about 25 per cent to the floor space of the factory. Woodworking operations will be carried on mainly in the new part. There will be two Andrews dry kilns in the basement and various types of woodworking machinery on the other floors. Electric drive is used throughout the factory, and, so far as possible, individual motors are used. Electricity is purchased from the Commonwealth Edison Company. A feature of the addition to the factory will be a large elevator, in which an automobile may be driven from the street and hoisted to any floor above. An exhaust system is installed by which the shavings from the various woodworking departments are conveyed to the basement, where they are burned under boilers which generate steam for heating the dry kilns. The company gives its entire attention to the manufacture of high-grade electric carriages, and it turns out from 500 to 600 cars a year. Its output is sold from three to four months ahead, usually. The officers of the Woods Motor Vehicle Company are: President, L. E. Burr; secretary, Thomas Clements; treasurer, A. G. Becker; works manager and engineer, F. J. Newman; sales manager, C. J. Metzger.

Weekly Record of Electrical Patents

UNITED STATES PATENTS, ISSUED JULY 27, 1909.

[Conducted by W. F. Bissing, Pat. Law, 2 Rector St., N. Y. City.]

927,816. (Issued July 13.) SELECTIVE RINGING AND TALKING DEVICE; C. O. Sisler and L. D. Smiley, Uniontown, Pa. App. filed Oct. 2, 1908. Lock for selective communication between parties on the wires in which a pawl and ratchet operates a switch, the ratchet being worked by a key.

928,373. (Issued July 20.) SANITARY GUARD FOR TELEPHONES; S. E. Florsheim, Chicago, Ill. App. filed April 5, 1909. A cup guard, attached to a mouthpiece made of collapsible material, for shipment.

929,001. RHEOSTAT; R. R. Noble and L. E. Mitchell, Chicago, Ill. App. filed Feb. 5, 1909. The combination of a frame with a plurality of grid resistance supports slidably mounted in the frame and doors engaging with the supports for holding them in position.

929,011. ELECTROMAGNETIC WINDING GEAR FOR CLOCKS AND THE LIKE; K. Puttkammer, Gross-Lichterfelde, near Berlin, F. Orthmann, Charlottenburg and J. Schindler, Berlin, Germany. App. filed Dec. 5, 1907. Details in electromagnetic winding apparatus, making use of a U-shaped armature enclosing the magnet coil.

929,017. METAL-DEPOSITING APPARATUS; J. K. Reynard, East Elmhurst, N. Y. App. filed Feb. 14, 1906. Deposits a gold layer on the wax of phonograph records by mounting the apparatus in a vacuum chamber.

929,025. TELEPHONE STAND; C. R. Schafer, Syracuse, N. Y. App. filed March 24, 1908. A telephone stand carrying an arm and an adjustable bracket having a clamp at one end to support the receiver, leaving the hands free.

929,026. WIRE CLAMP OR SUPPORT; O. F. Scholz, Charleston, W. Va. App. filed Feb. 17, 1909. A cap with parallel flanges, wire clamps engaging, the clamps grasping the wire and having serrated edges.

929,041. CONTROLLER ATTACHMENT; J. Sontag, West New York, N. J. App. filed Oct. 17, 1908. Controller drum with a contact finger whose face is provided with a recess carrying insulating material to prevent burning.

929,094. ILLUMINOUS ELECTRIC HEATER; F. Kuhn, Detroit, Mich. App. filed Dec. 12, 1908. The heater gives light and heat and carries a reflector, including a central standard.

929,095. ELECTRIC HEATER; F. Kuhn, Detroit, Mich. App. filed March 22, 1909. A flat heater having a hot plate, a heating unit on its under side and a casing, including an air chamber.

929,097. OUTLET OR JUNCTION BOX; G. A. Lutz, New York, and C. C. Sibley, Perth Amboy, N. J. App. filed Nov. 29, 1905. The box has socket members provided with walls, which have offset channels adapted to receive extensions or conduits.

929,116. GAS STOPPAGE ALARM; W. E. Apt and E. L. Schott, St. Joseph, Mo. App. filed Nov. 30, 1908. For giving a signal when the flow of natural gas ceases by means of an outer cylinder, an inner cylinder, an alarm bell and a float mounted within the inner cylinder, actuated by gas pressure.

929,118. BATTERY SUPPORTING MECHANISM; T. V. Buckwalter, Altoona, Pa. App. filed Jan. 20, 1909. A cradle for protecting batteries on trucks against vibration by means of elastic hangers, having three points of connection with the frame above the center of gravity.

929,121. STORAGE BATTERY; R. N. Chamberlain, Depew, N. Y. App. filed Oct. 9, 1906. A storage battery cell having a plurality of battery plates, alternately positive and negative, and an outside positive plate of greater capacity than either side of the inside positive plates.

929,123. ELECTRIC METER; T. Duncan, LaFayette, Ind. App. filed Feb. 1, 1909. An integrating watt-meter for large currents having a supplemental pressure field winding normally cut out of the field and manually brought into and out of operating relation with the meter armature to test its speed.

929,132. INSULATOR; E. R. Hill, East Orange, N. J. App. filed May 25, 1908. Makes use of strong metal bonds for securing the wire support to the insulating member and the latter to the supporting base.

929,142. METHOD OF TREATING SLAG; S. B. Ladd, Washington, D. C. App. filed June 2, 1906. For recovering copper from slags by transmitting an electric current through a flowing body of slag in a direction transverse to its line of flow, superheating the slag and permitting the metal to subside.

929,185. ALTERNATING DIRECT-CURRENT SYSTEM OF CONTROL; H. L. Beach, Wilkinsburg, Pa. App. filed March 3, 1906. For railway vehicles supplied from a grounded track rail in which the trolley is held out of contact when the motor circuit is open and in contact when the motor circuit is closed.

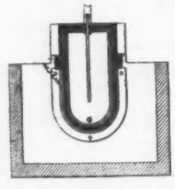
929,186. SYSTEM OF ELECTRIC MOTOR CONTROL; H. L. Beach, Wilkinsburg, Pa. App. filed Sept. 26, 1907. For electric vehicles containing the combination of a supply conductor, a transformer, and a current collecting device engaging the conductor and electrically connected to the transformer with means depending on the transformer circuit for automatically moving the current collector out of engagement with the supply conductor.

929,187. CONTROL SYSTEM FOR ELECTRIC MOTORS; H. L. Beach, Wilkinsburg, Pa. App. filed Nov. 8, 1907. A plurality of motors are provided with control switches, operating amgnets for the switches, secondary batteries for the magnets and means for charging the batteries from unlike sources of energy with automatic means for selecting one of the charging means.

929,211. POSITION INDICATOR FOR ELEVATORS; R. A. Griswold and J. Zang, Seattle, Wash. App. filed May 26, 1908. Stationary contact members and movable contact members control lights and a switch is provided to change the signaling point relative to the travel of the elevators.

929,214. RAILWAY SIGNAL; S. T. Harvel, Lawrence, Kan. App. filed Feb. 4, 1908. A circular spectacle case supported on a pivot and having a semaphore arm extending from its edge.

929,094—Illuminous Electric Heater.



929,469—Electrolytic Cell.

929,219. METHOD OF TREATING ALUMINOUS MATERIALS; Aldus C. Higgins, Worcester, Mass. App. filed May 31, 1907. Fuses aluminous material in an electric furnace at a temperature above quiet fusion and chills the product.

929,256. ELECTROMAGNET; A. E. Sink, New York, N. Y. App. filed Jan. 25, 1909. The coil is provided with a composite wire comprising a plurality of insulated strands intertwined and a variable resistance enclosed circuit with one of the strands.

929,269. ELECTROMAGNET FOR CLOCKS AND MOTORS; C. Arnold, Hamburg, Germany. App. filed May 11, 1908. For small motors in which a resistance takes up the spark, the resistance being in the form of an inductionless double coil wound upon the magnet coil.

929,276. ELECTROLYTIC DIAPHRAGM AND METHOD OF MAKING THE SAME; A. G. Betts, Troy, N. Y. App. filed Jan. 7, 1909. Prepares asbestos board by treating it with powdered sulphur and heats the board to melt the sulphur.

929,280. LAMP; E. C. Broadwell and J. A. Lyons, Chicago, Ill. App. filed March 18, 1905. An incandescent lamp in which the thread consists of metallic chromium with metallic oxides and a mantel of earth oxides encloses the thread, but is out of contact therewith.

929,284. THIRD-RAIL OR OTHER ELECTRICAL CONDUCTOR; W. J. J. Burch, Chicago, Ill. App. filed Jan. 7, 1907. A third-rail with flanges on its under side, the rail receiving contact shoes and being provided with an insulating covering supported by the flanges carrying a supply cable.

929,312. ELECTROPLATING PLANT; W. R. King, Newark, N. J. App. filed Nov. 13, 1908. For plating hoop iron, etc., by passing it in a strip through a series of baths. Details.

929,319. RELAY; F. R. McBerty, New Rochelle, N. Y. App. filed Sept. 5, 1908. A relay having an energizing spool with a projecting core and a contact terminal projecting through the core together with a magnetic yoke.

929,332. ELECTRODE SUPPORT FOR FLAMING-ARC LAMPS; R. Scott, Newark, N. J. App. filed July 27, 1907. A stop for the electrode consisting of a button made of equal parts of zinc and aluminum, which has the property or repelling the arc.

929,338. CURRENT-CONTROLLING MECHANISM FOR RAILWAY MOTORS; A. B. Stitzer, Philadelphia, Pa. App. filed Feb. 18, 1909. For four motor cars to avoid a closed loop circuit in which the armature and field of each motor are arranged in series. Provides means controlled by the controller to open and close the circuit at a point in the loop including the several motors.

929,339. CURRENT-CONTROLLING MECHANISM FOR RAILWAY MOTORS; A. B. Stitzer, Philadelphia, Pa. App. filed Feb. 18, 1909. A four-motor car, in which damage to the reverse cylinder is avoided by means controlled by the controller to open and close the circuit at a point including the several motors.

929,349. WIRELESS TELEGRAPH SYSTEM; C. R. Underhill, Providence, R. I. App. filed Aug. 10, 1904. A wireless receiving device in which all the devices are controlled by a high-resistance relay or equivalent device. Details.

929,353. INTERRUPTER; R. H. Wappler, New York, N. Y. App. filed Dec. 9, 1907. A mechanical interrupter for X-ray apparatus by means of which a varying flux is set up in a magnetic circuit for actuating the contacts to make and break the circuit.

929,354. GAS CHAMBER FOR ARC LAMPS; E. P. Warner and C. Wiler, Chicago, Ill. App. filed Sept. 12, 1906. The gas cap has an airtight globe surrounding the arc, the cap including an outer and an inner chamber with a common passageway through which the gases pass, the gases acting as a check to prevent the free entry of air.

929,363. ELECTRIC SIGNAL FOR RAILWAY SWITCHES; F. Zele, Cleveland, Ohio. App. filed March 8, 1909. A switch and signal operated by a track instrument struck by the wheels of trains.

929,371. ASYMMETRIC CELL; W. C. Arsem, Schenectady, N. Y. App. filed March 18, 1909. Includes a metallic, mercury anode and a co-operating electrode and a solution containing a reagent which will interact with the mercury to form an insulating film.

929,393. RELAY; F. B. Corey, Schenectady, N. Y. App. filed March 20, 1909. Relay for railway signaling having a non-fusible contact block and a metallic contact piece normally resting thereon, with a metallic contact relatively movable into and out of engagement with the contact piece.

929,404. TELEPHONE ATTACHMENT; B. E. Detrick, New Albany, Ind. App. filed Feb. 14, 1908. By means of a wire bracket attached to the transmitter's stand the telephone receiver is carried in operative and in inoperative positions, thus leaving both hands free.

929,444. TRACK DEVICE FOR RAILWAY SIGNALS; M. M. Kane, Montgomery, Ala. App. filed Nov. 17, 1908. Controls a signal by a track instrument.

929,469. ELECTROLYTIC CELL; J. McPhail, Carteret, N. J. App. filed Feb. 5, 1909. The vessel is of rectangular form and carries a vessel within it, the inner vessel havnig portions meeting the projections of the outer vessel.

929,473. SOLDERING TOOL; J. L. and O. G. Nilsson, Chicago, Ill. App. filed Jan. 13, 1908. Details in a soldering tool with the coil removably secured to the tip and removable contact ends.

929,487. WIRELESS SIGNALING SYSTEM; V. Poulsen, Copenhagen, Denmark. App. filed Dec. 24, 1906. Supplies an atmosphere of hydrogen to the arc for producing electric waves and varies the supply according to the signals to be transmitted.

929,492. COLLECTOR BRUSH; H. G. Reist and J. E. Noeggerath, Schenectady, N. Y. App. filed July 28, 1904. Includes a box having overhanging portions to form a partially closed slot and a plurality of conducting leaves with their upper portions in the slot.

929,506. FUSE BOX; E. Sherwood, Honesdale, Pa. App. filed May 18, 1908. A fuse holder having means for engaging the conductor, a pin for holding one end of the fuse and a flange for engaging a portion of the fuse adjacent to the part engaged by the pin.

929,517. METHOD OF TREATING ALUMINUM ORES; F. J. Tone, Niagara Falls, N. Y. App. filed March 3, 1909. Works with a mixture of aluminum silicate and emery by placing them in the furnace in which two electrodes dip which are raised as the column of purified product increases.

929,518. PROCESS OF TREATING ALUMINUM-SILICATE ORES; F. J. Tone, Niagara Falls, N. Y. App. filed May 4, 1909. The method of smelting aluminum silicate which consists of subjecting a charge of the silicate base, metalliferous material, and carbon to electrically developed heat, partially reducing the silica, adding further metalliferous material, and completing the reduction of silica.

929,525. RELAY; J. F. Webb, Jr., Denver, Col. App. filed May 12, 1908. A relay having an armature, with operating magnet, a stepped block secured to the armature and a keeper co-operating with the block to lock it in various positions.

929,528. CABLE THREADING HEAD; F. S. Woodward, Brooklyn, N. Y. App. filed May 24, 1905. To facilitate drawing a cable into a conduit. The head has two parts, each having a plurality of perforations, one for each conductor of the cable.

929,531. DEVICE FOR CONVERTING ORDINARY CLOCKS INTO CLOCKS WITH ELECTRIC DRIVING MEANS; August Anders, Charlottenburg, Germany. App. filed June 19, 1908. An ordinary clock is provided with electrical driving means.

929,543. INSULATING APPLIANCE; W. A. Bonnell, Brooklyn, N. Y. App. filed May 3, 1906. A coupling for outlet boxes made in two parts having upper and lower jaws to bind the conduit.

929,578. TREATING METAL FILAMENTS; C. T. Fuller, Schenectady, N. Y. App. filed Aug. 24, 1907. Mixes the compound with a binder, shapes it into wire, fires it in a reducing atmosphere, thus shrinking the residue.

929,582. ELECTRIC CURRENT RECTIFIER; E. Garretson, Buffalo, N. Y. App. filed Sept. 10, 1908. Comprises a body of silver sulphide and a body of metallic oxide in electrical contact therewith.

929,587. ELECTRIC LOCOMOTIVE; M. R. Hanna, Schenectady, N. Y. App. filed Sept. 11, 1906. Circulates cooling air through a conduit extending from the truck motor to the bearing.

929,591. BLOCK SIGNAL SYSTEM; L. A. Hawkins, Schenectady, N. Y. App. filed Sept. 21, 1906. The rails act as a return for power current; one rail is continuous for all the currents and the other is divided into sections to form signaling blocks.

929,602. TRANSMITTER FOR ELECTRIC TELEGRAPHS AND THE LIKE; C. L. Krum, Chicago, Ill. App. filed April 11, 1904. A transmitter for telegraphs having a set of relays operated in order and imparting a succession of impulses to the line at each operation of the set and a series of controlling keys for modifying the impulses.

929,603. TRANSMITTER FOR AUTOMATIC TELEGRAPH; C. L. Krum, Chicago, Ill. App. filed Aug. 31, 1906. For transmitting code impulses in which a series of switches is operated by a series of key controlled type, each switch being actuated by a number of type and each type simultaneously operating a particular combination of switches together with locking means to lock the switches.

929,607. INDUCTION COIL; B. L. Lawton, Meriden, Conn. App. filed Jan. 12, 1909. The coil is wound in sections by simultaneously winding a plurality of adjacent coil sections and simultaneously interposing sheets of insulating material between the sections.

929,609. ELECTRIC CIRCUIT CONTROLLER; H. W. Leonard, Bronxville, N. Y. App. filed Nov. 7, 1907. An automatic release with a mechanical locking device for holding a switch lever in operative position while the circuit remains normal, and released by an electromagnet.

929,635. ELECTRIC SWITCH; N. H. Suren, Needham, Mass. App. filed May 23, 1908. A switch arm having a pivot stud and a spring mounted on the stud, pressing against the arm. Details.

929,643. ARC LAMP; J. Harden, Schenectady, N. Y. App. filed Dec. 26, 1903. Flaming arc having an auxiliary electrode movable into contact with the arcing end of the consuming electrode shortly after current is cut off from the lamp.

12,992. (Reissue.) MANUFACTURE OF SPAR INSULATORS; F. M. Locke, Victor, N. Y. App. filed Dec. 22, 1908. Subjects feldspar to a high temperature, which makes it pliable, then heats it and molds the product.